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The Black Death and the Intellect of Europe

By NATHANIEL WEYL

The Black Death, a pandemic of bubonic plague which swept across Europe between 1347 and 1350 was probably the greatest single disaster—measured by the proportion of mankind that it killed—in history. The pioneer German medical historian, J. F. C. Hecker, estimated that 25 million Europeans of a population of 105 millions perished.[1] George Macaulay Trevelyan thought that from a third to a half of the English people died. An Italian scholar estimated the toll at 40 per cent to 60 per cent of the urban population of Italy.[2] A modern writer believes that the mortality for Europe as a whole ranged somewhere between 23 and 45 per cent.[3]

The question we are here concerned with is not: How many died? Rather it is: On what groups and classes in the population did plague mortality fall most heavily? We know that the Black Death was genocidal. Was it aristocidal as well?

To attempt to answer this question by comparing the estimated population of Europe immediately before and immediately after the disaster and by attempting to weigh against that gap the indicated mortality among specific classes and professions would involve such large margins of error that the end-result would be of dubious value. A more direct approach to the problem is to examine how the plague was transmitted and then ask what groups of people lived under conditions of maximum—and also of minimum—risk of infection.

VECTORS OF THE PLAGUE

Bubonic plague is caused by the infection of the body with the plague bacterium, *Pasteurella pestis*. This is an internal parasite of rodents, particularly rats. The normal course of infection is for one of two species of fleas, of which by all odds the more common is *Xenopsylla cheopis*, to feed on diseased rats and thus ingest the plague bacterium with the rat's blood. The plague bacteria

[1] J. F. C. Hecker, *The Epidemics of the Middle Ages*, London, 1844, pp. 30-31.

[2] A. Doren, *Storia Economica dell'Italia nel Medio Evo*, Padua, 1937, p. 579.

[3] Philip Ziegler, *The Black Death*, New York, 1969, p. 230.

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establish themselves in the flea's stomach where they rapidly multiply until they occupy its entire mass. When this occurs, the rat-flea is said to be in a "blocked" state. No food can reach its stomach or nourish it. The flea becomes ravenous and, no matter how much it sucks blood, inevitably starves.

When these famished insects attack human hosts, they suck the blood of the latter until their gullets become so enlarged that they contract involuntarily, forcing regurgitation. While the flea sucks blood, it defecates. Both the plague-infected regurgitated matter and the plague-infected feces are introduced into the blood stream of the human host through the puncture made by the flea. Thus, the human being becomes infected.

Since the fleas fed preferentially on rats, they generally abandoned them for human hosts only when they were dead and cold and when other rats were not immediately available. The presence of abnormally large numbers of dead rats in the houses and streets of medieval cities was a harbinger or sign of bubonic plague.

Not more than 12 per cent of the fleas preying on black rats belong to the two species which serve as plague carriers. Infection through the more direct route of man-flea-man is virtually impossible because *Pasteurella pestis* does not reach high enough concentrations in the human blood stream. However, direct man-to-man infection is entirely possible if the plague infects the lungs of a human being. In this pneumonic form of the pestilence, mortality approaches 100 per cent.

Climate affects the course of the epidemic. *Cheopis,* the most prevalent flea-carrier of bubonic plague, thrives best at temperatures of between 64 and 72 degrees Fahrenheit. In its blocked state, *cheopis* can be killed by cold snaps, heat waves and drought.[4]

The mammal carrier of bubonic plague is *Rattus rattus,* the house rat, or so-called black rat. This rodent is timid and non-ambulatory. It normally lives in or around houses, using for its own purposes the shelter which man erects and eating by preference such human foods as grain. The house rat avoids water and will not migrate or cross rivers on its own initiative unless compelled to move by famine, epidemic disease or natural disaster. The house rat normally spreads over an area only to the extent that is moved by human agencies such as ships, caravans or wagons.

The original home of the black rat was probably India. It may have burst into the Mediterranean world around the time of

[4] For an admirable detailed and recent account of the vectors of bubonic plague, one on which I have leaned heavily, see J. F. D. Shrewsbury, *A History of Bubonic Plague in the British Isles,* Cambridge, 1970. Dr Shrewsbury is Emeritus Professor of Bacteriology at Birmingham University.

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Alexander the Great, although it is possible that it did not arrive there until the Christian era.[5]

The plague of Justinian, which began in 540 A.D., was the most disastrous in the medical history of the ancient world. Its admirably clear description by Procopius leaves no doubt that it was bubonic. It reportedly caused 10,000 deaths daily in Constantinople alone, contributed to an unknown extent to Justinian's failure to re-establish a unified Roman Empire, and was characterised by one medical writer as perhaps "the most terrible (pestilence) that has ever harried the world.[6]"

Why did this disaster occur at the time it did?

One reason was the conversion of Rome to Christianity two centuries previously. Pagan Rome had a water, sewerage and sanitation system that Europe would not be able to match for the next thousand years. A hundred years after the birth of Christ, 10 aqueducts supplied the Eternal City with abundant amounts of pure water for its two million inhabitants. About half of this was set aside for the great public baths which were available to the populace at a reasonable cost.

When Constantine the Great brought the Roman Empire to Christianity, the Church was able to destroy these and other public institutions devoted to bodily cleanliness. Leaving his native Dalmatia, St Jerome came to Rome in the middle of the fourth century. He was aghast to discover that the city had 900 public baths. He considered them resorts of sin and urged that they be transformed to baptistries. As Darlington summed it up: "The man who had bathed in Christ, in his opinion, needed no second bath.[7]"

For centuries, the Church would associate the public baths, which were sometimes centres of prostitution, with the sin of lust. The Italian word for bath, *bagnio,* also meant, and still means, brothel.

The Church brought about a vast regression toward bodily and urban filth in that portion of the world which it dominated. Consequently, Christendom suffered from plagues and other diseases of dirt for at least 12 centuries. The elimination of public baths and the desuetude or destruction of the admirable Roman

[5] The Great Plague of Athens during the Peloponnesian War was almost certainly not bubonic because its historian, Thucydides, did not mention swollen bubos as a symptom and because there is no good reason to suspect that *Rattus rattus* was in Greece at the time. The first clear description of bubonic plague comes from Rufus of Ephesus who flourished around 100 A.D. He refers to earlier plagues and cites authors whose works have been lost. The date assigned to the appearance of *Rattus rattus,* therefore, depends on whether Rufus was accurately summarizing older writers or imputing to them his own observations.

[6] Frederick F. Cartwright, *Disease and History,* New York, 1972, p. 17.

[7] Cyril D. Darlington, *The Evolution of Man and Society,* New York, 1969, p. 300.

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aqueducts made bodily cleanliness impossible for the poor and inconvenient for the rich. The plague-carrying fleas that earlier pagan generations would have reduced in number or eliminated by frequent baths and changes of clothing were now regarded as part of man's natural lot. Their presence or absence was unimportant since they had nothing to do with salvation of man's immortal soul.

Given this descent from cleanliness to squalor, how does it happen that, after Justinian's plague and its *sequellae* disappeared around 590 A.D., Europe remained free of bubonic plague—or at least no authenticated epidemics of this particular pestilence occurred—for about seven centuries?

The event that probably caused this temporary immunity, according to the distinguished French medieval historian, Henri Pirenne, was the rise of Islam and the consolidation of its political power. This new empire served as a formidable barrier between India, the habitat of the plague-carrying rat, and Europe.

Mohammedans did not share the Christian aversion to washing. The *Koran* imposes daily ablutions, though generally merely of a ritual character, as a religious duty. At a time when the vast public baths of Caracalla and Diocletian lay abandoned, Muslim Cordoba boasted, perhaps with exaggeration, of 700 public baths.[8]

The final disappearance of bubonic plague from Europe was caused in part by the appearance of a rival rodent species, *Rattus Norvegicus,* the Norwegian rat, brown rat, or field rat. Vast migrations of this steppe-dwelling rodent from Russia to western Europe were reported toward the beginning of the eighteenth century. The brown rat apparently arrived in England by sea in 1728, in France and Prussia in 1750, in the United States in 1775, in Switzerland in 1809 and in Spain possibly as late as 1880.[9]

Stronger and fiercer than *Rattus rattus,* the brown rat does not have a symbiotic relationship to man, migrates at will, and has no fear of crossing water. Since the brown rat normally lived in the fields, it was not dangerous to man as a bubonic plague carrier. The invading brown rat rapidly drove off and destroyed its rival, becoming the only species of quantitative importance in most of Europe and other temperate-zone areas. The black rat withdrew to such enclaves as ships, waterfronts and tropical regions.

THE GEOGRAPHY OF DEATH

The Black Death struck Europe in the winter of 1346-47. Its

[8] Will Durant, *The Age of Faith,* New York, 1950, p. 302.

[9] J. F. D. Shrewsbury, *op. cit.,* p. 9.

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first point of contact was Kaffa, a fortified Genoese trading post and cathedral town in Crimea and on the Black Sea. Kaffa was located on one of the safer routes of trade between India and Europe; by sea from Indian west coast ports to the mouth of the Tigris, up the Tigris by smaller vessels toward the stream's source in Armenia, then overland by caravan to the Black Sea.

Presumably, plague-infected black rats were carried by ship and caravan from India to the Crimea. In 1346, bubonic plague broke out among Tartar forces which were besieging Kaffa and had almost reduced its defenders to starvation. The Tartars loaded their catapults with the corpses of plague victims, which were then hurled over the city walls, scattering plague-infected fleas into a crowded area swarming with house rats.

From Kaffa, the plague moved primarily by sea, covering the entire coasts of the Mediterranean by the summer of 1347. Moving inland and by Atlantic sea routes, the bubonic plague did not reach Scandinavia and Russia until 1350. Significantly, a large region deep in the interior of the European continent, comprising most of Bohemia and much of Poland, remained substantially free of the Black Death, as did other and smaller enclaves, one of which was isolated by the Pyrenees.[10]

The Black Death struck hardest at seaports and coastal regions. Since the house rat avoided water crossings where possible, interior regions protected by swamps and marshes were comparatively immune.[11]

The cities suffered far more severely than the countryside. The primary reason for this is that the house rat would have no trouble in moving from dwelling to dwelling in the crowded towns of medieval Europe, whereas, in a large part of the countryside, the population density was too low to make the migration of plague-infected rats probable or to complete and perpetuate the chain of infection.

There is a consensus of evidence in support of the proposition that bubonic plague epidemics were primarily an urban affliction. Doria, in a reference already cited, estimated that the Black Death killed 40 per cent to 60 per cent of the inhabitants of Italian cities, but affected a far smaller proportion of rural Italians. Shrewsbury states that this pestilence "by reason of its immutable nature, is principally an urban disease. . . ." He believes that the rural death toll in England did not exceed 5 per cent of the population, an extremely low figure which few other authorities would accept.[12] At least five English counties had "population densities so low that it would have been biologically

[10] Philip Ziegler, *op. cit.*, map on pp. 105-106.

[11] J. F. D. Shrewsbury, *op. cit.*, p. 54.

[12] J. F. D. Shrewsbury, *op. cit.*, p. 123.

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impossible for bubonic plague to have spread over any of these counties in the fourteenth century.[13]"

Where the plague raged in its pneumonic form population density would be the greatest single factor determining potential contagion. Here again, the cities would suffer far more severely than the countryside.

Then as now, most of the upper class, of the clergy, of the administrative and military bureaucracy, of the intellectuals and the professionals, of the merchants, manufacturers and skilled artisans, were concentrated in the towns and hence lived in the areas of maximum exposure. Within the rural regions, the geographical impact would involve greater morbidity in the densely, than in the sparsely, populated rural regions. Since the former generally have better land, a legitimate inference would be that, within the rural regions, the richer areas and consequently the more capable and successful cultivators would be the principal victims.

If Shrewsbury and other authorities are even approximately right about the differential between urban and rural Black Death mortality, then the pandemic must have afflicted southern Europe far more massively than northern Europe. The reason for this is that the great cities of the Continent at that time were almost entirely on, or adjacent to, the Mediterranean. Using a variety of different estimates, culled by Will Durant and Henri Pirenne from different sources,[14] we find that Constantinople was believed to have had a population of 800,000 and Cordoba and Palermo about half a million each. By 1300 A.D., Paris boasted 150,000 inhabitants; Venice, Milan and Florence were probably slightly below 100,000. Among the trans-Alpine cities, London had 35,000 inhabitants in 1377, while Cologne, Luebeck and Nuremberg were even smaller. England was 90 per cent rural. Scandinavia, Scotland and Ireland remained overwhelmingly countryside.

Thus, several generalizations have been made about the distribution of bubonic plague epidemics. In each case, they have been derived from the nature and behavior of the plague vectors. The first obvious necessity was for *Rattus rattus* to be introduced into the Mediterranean world and for enough time to elapse so that this rodent population could achieve sufficient density so that the pestilence could be spread by haphazard rat contacts. This probably occurred either around the beginning of the Christian era or several centuries earlier. A second factor was the lapse from the fairly high standards of personal cleanliness prevailing in pagan Rome. This meant that most people were flea-infested and hence that diseased fleas would have little trouble in finding and

[13] J. F. D. Shrewsbury, *op. cit.*, p. 53.

[14] Will Durant, *The Age of Faith*, New York, 1950, p. 642; Henri Pirenne, *Medieval Cities*, New York, 1956.

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feeding upon human hosts. The third time factor was probably the rise of Saracen power, which drastically restricted commercial intercourse between Indian and medieval Europe and which also imposed what might be called a personal hygiene barrier between the two regions. Finally, the invasion of Europe at the beginning of the eighteenth century by *Rattus Norvegicus* and his ecological victory over the black rat cut off a link in the chain of propagation and ended the threat of bubonic plague to the peoples of Europe.

CLASS IMPACT OF THE PLAGUE

From a class standpoint, the great brunt of the mortality of the Black Death fell upon the shoulders of the poor.

Throughout Europe, a very large proportion of the poor lived in mud or wattle-and-daub huts, roofed with straw or thatch. People slept either naked or in their clothes on the floor of hard earth or else on trestles covered with straw. The house rat with its flea parasites would make its home in burrows under the earthen floor or else in the thatch roofs, emerging from its dark hiding places at night. Plague-carrying *cheopis* fleas would drop from the infected rats in the roofs to the human beings sleeping below them. Since the latter were huddled together, the insects could move from one human host to the next.

In the towns, living conditions were little better, but the roofs were less frequently of thatch and, to that extent, the danger of contagion was narrowed.

The situation of the nobles was entirely different:[15]

> The stone-built castles with their resistant walls and unfriendly roofs, and the manor houses with their moats would also be uncongenial to it (*Rattus rattus*). There is nothing surprising therefore about the almost complete exemption of the English nobility and landed class from "The Great Pestilence;" it just happened that the house rat could not make itself at home in their castles, "peel towers," and manor houses. The brick-built house with its slated or tiled roof was also inimical to it, and the national development of this type of building was probably the most important single factor in the eventual disappearance of the house rat from the bulk of England.

The class-limiting factor was the rat, not the flea. All classes in English society were verminous. As for privacy, "Hoccleve writes of an earl and countess, their daughter and their daughter's governess who all slept in the same room.[16]" For them to have slept in the same bed would not have been remarkable

[15] J. F. D. Shrewsbury, *op. cit.*, p. 35.

[16] Philip Ziegler, *op. cit.*, pp. 151-152.

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and, had they been impoverished, to lack even the bed. The fleas however, could not spread bubonic plague in dwellings impervious to the black rat.

Regional differences also affected the impact of the Black Death. In England, the great importance of the wool trade meant that a staple was produced and transported in bulk in the bales of which *Rattus rattus* could readily lodge. Building materials varied from region to region and, throughout almost the entire Mediterranean area, a chronic shortage of lumber affected housing. But to analyse the possible effects of these local, national and regional differences would take us far afield.

There is a general consensus that the nobility escaped the worst of the disaster. "Many writers inveighed against the flight of the rich," Nohl wrote, "which gave rise to ill-feeling among the poorer classes. Nearly all reports of contemporaries agree in stating that the plague claimed most of its victims among the poor and badly nourished, for whom, as Simon de Couvino says, life itself was a kind of death. This bitterness was carried so far that the people in various towns of Italy believed that the plague had been artificially caused by the rich. . . . More than once it is reported that the raging peasant roasted noblemen in the presence of their wives and children, and then forced the wives to eat their flesh and ultimately murdered them after the most brutal violation."[17]

As for the intellectuals, we have some information—and a good deal of misinformation—concerning the havoc wreaked at Oxford and Cambridge. Archbishop FitzRalph, who had been Chancellor of Oxford before the Black Death, wrote in his *Defensorium Curatorium* (1357) that the student population of Oxford had been cut down from 30,000 in his day to 6,000 after the pestilence had disappeared.[18] Every responsible historian of the plague has characterised this assertion as typical of medieval statistical irresponsibility since the town of Oxford could not possibly have housed anything approximating 30,000 students.[19] George Deaux concludes "that the students were no more fortunate than any other group in avoiding the plague and that between a third and half of them were very likely carried off by it."[20] In Shrewsbury's judgment, there are few actual records of deaths at Oxford University, which is "not strange in view of later records that at both Oxford and Cambridge the masters and

[17] Johannese Nohl, *The Black Death, A Chronicle of the Plague Compiled from Contemporary Sources,* London, 1926, 1971, pp. 94-95, 98.

[18] George Deaux, *The Black Death 1347,* London, 1969, p. 133.

[19] George Deaux, *op. cit.,* pp. 133-134; J. F. D. Shrewsbury, *op. cit.,* p. 81; G. G. Coulton, *The Black Death,* London, 1929.

[20] George Deaux, *op. cit.,* p. 134.

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scholars immediately fled into the country at the first hint of plague. . . .[21]"

The town of Cambridge, together with the London area, had the unenviable distinction of being one of the worst centers of plague mortality in England. The mortality rate was estimated to be 5 per cent of the total population. However, the academic authorities had the good sense to order the University closed during the worst period of the pestilence and it can be assumed that faculty and students departed to healthier places.

The wealthier, the better educated, the more powerful and the more intelligent were better able to avoid death from bubonic plague, as a rule, than more ordinary people. Some, like Pope Clement VI at Avignon, would seek to isolate their dwellings from intrusion by people who might prove to be infected. Others, like Boccaccio, would leave the cities for safer places in the countryside.

This relative immunity did not, however, affect all the professions and callings which were attractive to the educated, the rich and the powerful. When universities neglected to close their doors during a plague epidemic, their faculty and students were placed at an abnormally high risk. In fact, any institution which kept large groups of people in close physical proximity to each other exposed them to pneumonic infection, which spreads directly from one human being to another and is almost invariably fatal. This danger applied to students and faculty in lecture halls and classrooms; to soldiers in encampment and bivouac, and to monks and nuns. An even greater danger of infection from pneumonic plague faced those priests, physicians and nurses who attended the sick and the dying.

We have a good deal of statistical evidence concerning the deaths among beneficed clergymen and these figures are more reliable, particularly where they are English, than any other quantitative data on plague mortality we possess.

One of the most astonishing estimates, based primarily on German data, is that "at least 35 per cent of the higher clergy" died of the plague.[22] Protected by their power and authority and seldom in close personal contact with their parishioners, these ecclesiastics were in a much better position to avoid infection and death than the population at large.

Fairly sophisticated studies of clerical records in 10 English dioceses show that the death rates among beneficed clergy ranged from 39 per cent for York to 49 per cent for Exeter, Winchester and Norwich.[23]

[21] J. F. D. Shrewsbury, *op. cit.*, p. 81.

[22] Philip Ziegler, *op. cit.*, p. 85.

[23] Philip Ziegler, *op. cit.*, p. 228.

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These figures seem extraordinarily high. The priests were better educated than the general population. They were more likely to live in stone dwellings largely impervious to rats. With higher standards of personal hygiene, they were less likely to be flea-infested or to live in rat-infested dwellings. They had greater mobility than most Englishmen. Their households probably were, on average, smaller and certainly offered more space per person. They were also considerably older than the average of the English population, a fact which non-medical historians of the plague assume "meant that, in any given year, a higher proportion of priests were likely to die,"[24] but which medical authorities assert would have the opposite effect.[25]

Shrewsbury suggests that the mortality figures reported for beneficed clergymen exaggerate the true state of affairs, since they include large numbers who fled their parishes and abandoned their calling. It is true that, throughout Europe, monastery after monastery was abandoned. An alternate explanation is that the great majority of beneficed clergymen carried on with their duties, comforting and giving absolution to the dying. The performance of these tasks would have made them peculiarly susceptible to death by the plague in its pneumonic form.

MASSACRES OF GERMAN JEWS

Another vector in the complex of forces which defined the direction and the impact of the Black Death on ability and intelligence is the massacres of the Jews which accompanied and followed the pandemic. These massacres occurred primarily in Germany, where Jewish community after Jewish community was burned to death or otherwise exterminated. Some of these Jewish communities dated back to their foundation by Jewish prisoners of war deported to Germany by Titus after the fall of Jerusalem in 70 A.D.

The ignorant mob became convinced that the Jews had caused the plague by poisoning the wells. Under torture, Jews were made to confess to this and other crimes. As a matter of fact, the Jewish communities avoided the wells, which were generally contaminated with sewage, and took care to obtain and drink pure water. However, since bubonic plague is not a water-borne sickness, this had nothing to do with the superior Jewish rate of

[24] Philip Ziegler, . cit., p. 128.

[25] J. F. D. Shrewsbury, *op cit.*, writes that Russell's "third observation is that the plague mortality rate among the beneficed clergy was higher than among the inquisitions group, which he suggests is explicable on the supposition that 'the clergy were probably far older on an average than this group and thus subject to a higher mortality', whereas modern knowledge of the disease indicates that they would have suffered less from the disease" (p. 51). The "inquisitions group" refers to 500 post-mortems performed during the period, from which the plague historian J. C. Russell derived an overall English mortality rate of 27.3 per cent, which he later—and probably erroneously—reduced to 23.6 per cent.

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survival. If the Jewish morbidity and mortality rates during the Black Death were lower—and this is by no means firmly established—the probable reason was their superior standards of cleanliness, their avoidance of vermin and rodents, and the fact that their dwellings were more impervious to the house rat than those of their non-Jewish neighbors.

Nohl points out with reason that these "deeply revolting" massacres of the Jews "were perpetrated exclusively on the tempestuous urging of the populace". The ruling classes and the educated minority knew that the accusations were baseless, "but from fear of the rabble and still more for the sake of material profit, not only held their peace, but in the most cruel manner participated in the slaughter of the innocent victims".[26] Clement VI, an Avignon Pope and a civilized and cultivated man of the world, not only condemned the massacres, but threatened those Christians who participated in them with excommunication.

The estimates of the numbers of Jews burned to death and otherwise slaughtered in German towns during the Black Death are probably not much more reliable than other medieval quantitative data. One historian sums it up by stating that 60 large and 150 smaller communities were probably exterminated and 350 massacres occurred.[27] A large number of the survivors fled to Poland and Lithuania where they found new homes.

The aristocidal significance of these massacres of German Jews was undoubtedly enormous. Over 10 years ago, Dr Stefan T. Possony and I used George Sarton's *An Introduction to the History of Science* to estimate the comparative contribution of various nationalities, ethnic groups, religions and regions to medieval science.[28] We found that of all the scholars, philosophers and scientists listed by Dr Sarton, 15.0 per cent were Jews in the thirteenth century and 10.9 per cent were Jews in the fourteenth century. World Jewish population was estimated at two millions in 1200 A.D. by Dr Salo Wittmayer Baron in his classic history of Jewry. This compared to a European population, according to Beloch and Carr-Saunders, of between 35 and 59 millions. Thus, the Jewish contribution to the intellectual life of the medieval world was proportionately much greater than that of Europeans in general, despite the disabilities, harassments, persecutions and massacres from which the Jews almost continuously suffered.

In conclusion, the Black Death represented such a *melange* of conflicting forces for differential mortality or survival that it is difficult to judge whether it was aristocidal in its net effect or the

[26] Johannese Nohl, *op. cit.*, pp. 116, 114.

[27] Philip Ziegler, *op. cit.*, pp. 108-109.

[28] Carnegie Institute of Washington, Washington D.C., 1927-47, three volumes.

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reverse. It bore down most heavily on the coastal regions, the seaports, and the Mediterranean centers of high civilization. It scourged the cities, where the ablest, the best educated, the brightest and the best of the population tended to congregate. In the rural areas, it was probably most severe in regions with good soils, comparatively prosperous peasantries and hence higher-than-average density of population.

In general, the Black Death spared the rich and smote the poor. The well-to-do, the educated, the intelligent and the powerful were able to flee the plague cities to the countryside, where many idled on their estates until the danger had passed. Others diminished the risk of contagion by isolating themselves within their town residences. On the other hand, mortality was probably very high among the physicians who attended plague victims. That portion of the literate minority which was cooped up either in monasteries, nunneries or universities faced greater than average risk, from pneumonic plague at least, unless they had the practical sense to flee or their superiors were pragmatic enough to close their institutions. According to all the statistics available, the parish priests suffered inordinately. It seems safe to conclude that in England at least 40 per cent and perhaps 50 per cent of this quantitatively significant element perished during the Black Death. Finally, the massacre of German Jewish communities and anti-Jewish atrocities of lesser importance elsewhere added a new aristocidal component to what was perhaps the greatest single catastrophe ever visited on the human race.

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The Gene's Place in Revolutionary Adaptation

By F. J. IRSIGLER*

PREFACE

This is a critical review of the premises on which the present-day Mutation-Selection ("synthetic") Theory of Evolution rests.

This theory started from an attempt to explain the origin of species in terms of universal lineal descent and has become, eventually, environmental to such an extent as to be hardly discernible from the milieu theory of historical and dialectic materialism as expounded by F. Engels, the life-long companion of Karl Marx, in *The Dialectics of Nature.*

The extent of this far-reaching transformation becomes apparent when one compares what education as a means of improving the human species meant to Humboldt, a humanist in the footsteps of Erasmus of Rotterdam, on the one hand, and the humanitarian Dobzhansky on the other. To Humboldt, education was equivalent to ennobling *(Veredelung)* man *in his individuality.* For Dobzhansky, educability, that is, the ability "to adjust one's behaviour to circumstances in the light of experience," is the diagnostic character of the human species, due to its human evolution. This premise leads Dobzhansky to conclude that anyone lacking educability is a pathological individual, a "misfit," hardly to be called human.

For environmental theory, the origin of adaptation, that is, adjustment to prevailing environmental conditions, is the prime problem in evolution. Adaptation is the result of natural selection, meaning the sum of all influences exerted by the environment, living and inanimate alike, on the organism. "The organism is adapted to the environment and not *vice versa*" (G. G. Simpson). Thus, we have a causal (and temporal) relationship though causation is indirect via differential reproduction.

This leads to an alternative: what is adaptive, namely in the direction of evolution, is equivalent to selected, meaning brought about by the environment, in terms of favoured gene complexes; and, conversely, what is not selected is identical with "random." It is an extraordinary fact, says Simpson, that most processes inherent in the genetic mechanism of evolution occur at random. Consequently, selective theory starts from a "gene chaos" and leads to niche specifity: when each species has its niche, and each

* My thanks are due to Dr C. Wallace, Johannesburg, for fruitful discussions on chromosomal analysis, and to Dr R. Gayre of Gayre and Professor Raymond A. Dart who both read the manuscript and offered most valuable suggestions.

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niche is occupied by only one species (Simpson). However, most species, states the founder of synthetic theory, even though already well fitted into a niche or adaptive zone, contine to change.

To explain this remarkable fact, Simpson refers to expansion and diversification which, according to him, are "of course, the main motifs in the rich fabric of life's history;" he adds: "but the whole pattern is astonishingly more complex." Indeed, not only more complex, for what we have here is evidently beyond the explanatory reach of selective theory based on the unilateral irreciprocal cause-and-effect relationship. To escape from this impasse the theory is compelled to transcend the confines of its own axiomatic system. It is known since Gödel (1931)[1] that the completeness and consistency of such a system can not be proven by its own axioms. Therefore, the principle of deterministic (Darwinian) causation has to be supplemented by the resort to chance or randomness. This constitutes the transcendent (and transcendental) element in selectionism.

For Simpson, the sequence from dogfish to frog, cat and man is not a historical, i.e. evolutionary, sequence but a logical one; nevertheless, the same author, in explaining the principle of transformation, when a way of life is changing in the course of evolution, refers to "historical causation."

Here the dilemma of orthodox selectionism and its positivistic approach emerges: the logical relationship projected into the "objective world." It is this kind of "misplaced concreteness"[2] which lies at the base of the environmental fallacy.

The objectivity of nature is, according to Monod, consubstantial with science; it is at the same time unproved and unprovable. Its dogmatic nature is shared by the so-called Sufficiency Postulate which states that natural selection (as defined above), a blind and automatic force, wholly mechanistic in its operation, is the only and sufficient agency capable of explaining evolution in purely materialistic terms.

The "Postulate of Objectivity" states that no true knowledge can be gained by interpreting natural phenomena in terms of "purpose" or "projects." It constitutes an antinomy, for it requires, at the same time, to admit that the living organisms act projectively, that is, they "realize and pursue a purpose" (Monod). Moreover, it leads, in its turn, to the Postulate of Precedence stating the priority, causal and temporal, of the genetic invariance as related to teleonomy, that is, structures and functions by which living beings achieve their "project." Herein lies what Monod calls "the fundamental dilemma."

[1] K. Gödel, "Uber formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme I," *Monatshefte fur Mathematik und Physik,* Vol. 38, 1931, pp. 173-198.

[2] This term is used by A. N. Whitehead, *Science and the Modern World,* Macmillan, New York, 1925, p. 66.

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It is the dilemma of the Darwinian causal chain: the organ, altogether determined by heredity→learning→adaptation, either phylogenetic or by individual acquisition of information. "Besides these two channels . . . no third possibility exists for information being 'fed into' the organic system" (K. Lorenz, 1965).

With the decline of logical positivism and its psychological counterpart, classical behaviourism, both the objectivity of nature and the misplaced concreteness of logical relation became increasingly eroded.

Under the impact of the quantum revolution the postulate of objectivity can be maintained only with the following qualifications: first, it is required that the system be isolated, that is, unperturbed; since observation introduces an irreversible element which, at least in part, determines the system's future, "isolated" becomes equivalent to "unobserved."[3] Second, the system must consist of a large number of identical particles and events of equal probability.[4] Third, the accuracy of experiments must be well above the limit defined by the uncertainty relations.

At the molecular level of evolutionary genetics these conditions are fulfilled only under special circumstances, to wit: (1) Instead of the "classical" deterministic congruence we are faced with contingency or arbitrariness, as exemplified by the "gratuity" of chemical reactions in allosteric proteins.[5] (2) The phenomena involving molecular evolution of nucleic acids (DNA and the various kinds of RNA) are not additive properties to be described by continuous, linear functions but singular events occurring in complete "ignorance" of a causative factor. This is not to be understood in terms of some sort of "a-causality" but as meaning that in these events the cause-effect mechanism becomes meaningless.

An analogue is provided by the process of antibody formation which takes place, according to modern views, by mutations as well as recombinations without previous exposure to the antigen.

Evidently, it is the singularity of these events which lies at the base of what has often been called "uncertainty in evolution," described by H. J. Muller: "The quanta of physics become the quanta of evolution." In experimental and population genetics alike, replication of experiments with the same genetic material and under similar environmental conditions often comes up with differing results, a situation that Dobzhansky[6] calls

[3] L. Brillouin, *Science and Information Theory,* Academic Press, New York, 1971.

[4] N. R. Hanson, *Patterns of Discovery,* Cambridge University Press, Cambridge, 1961.

[5] J. Monod, J.-P. Changeux and F. Jacob in the *Journal of Molecular Biology,* Vol. 6, 1963, p. 306.

[6] T. Dobzhansky, "Evolution at Work," *Science,* Vol. 127, 1958, p. 1091.

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"disconcerting" and making evolutionary transformations in living populations unrepeatable. According to this authority we encounter here "a real biological indeterminacy."

Again, the discontinuous character of evolution at the molecular level is at the root of the fact that the precise historical path of evolution can neither be explained nor predicted (M. Eigen. 1971).

Among the irregularities affecting more than one letter in the DNA code a certain group can be picked out as having the following characteristics: Involved are whole chromosomes or chromatides (in the case of meiosis), or pieces of them, resulting in numerical and/or structural aberrations; the changes occur during reducational as well as equational divisions in gametogenesis and fertilization, resulting in irregular or unequal exchange and crossing over; thus they are not identical with bisexual recombinations[7] nor confined to them. The changes are regular but independent of extra-organismic events, that is, they are non-adaptive. Finally, they constitute non-functional or inert, temporarily "switched-off" parts of the genome. This means that they are not manifested in their first carriers and do not benefit them: however, without being exposed to selective pressure, they are handed down to the offspring over periods of generations to be called up whenever opportunity or need arise. They thus belong to those "mutations" which Monod calls "individually undetectable."

It is these breakages and re-arrangements of the hereditary material, involving both duplication and fusion, which constitute the bulk and raw material of evolution. It is through them that "Chromosome Evolution"[8] takes place. It is at present the subject of a comprehensive study carried out in the Kruger National Park in Transvaal, South Africa. It was in the thirties that C. D. Darlington called attention to genetic isolation as an antithesis of Darwinian (geographic) isolation. By increasing its genotypic variability a breeding population decreases its inter-fertility and is split up into smaller groups without any external change in individuals to indicate "what has happened." It is thus that from irrelevant origins unpredictable sequences arise (Darlington).

Such views evidently are at variance with the environmental tenet picturing the genome as the sum-total of advantageous gene complexes composed by the creative, but blind, and automatic

[7] The first instance was described by R. R. Gates in 1908 in Oenothera rubrinensis as an unequal distribution of the 14 chromosomes at meiosis, later called "non-disjunction." Gates could hardly foresee the far-reaching implications of the process.

[8] M. A. Bender and E. H. Y. Chu, *Evolutionary and Genetic Biology of Primates*, Academic Press, New York, 1963, from C. Wallace and N. Fairall, "Chromosome Analysis in the Kruger National Park: Preliminary Results in the Bovidae," *South African Journal of Medical Science*, Vol. 33, 1968, p. 123.

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force of the external world. In contrast, the hereditary apparatus now emerges as a truly autonomous, self-organized and self-determining structure evolving along its own lines as defined by the breeding group as a dynamic, ever-changing whole. On the other hand, the function of the environment is conservative to such extent as to stabilize the newly acquired genetic information in a dormant state for the benefit of generations to come.

The basic concepts of extra-nuclear, i.e. cytoplasmatic, gene control have been outlined in detail by F. Jacob and J. Monod in their paper on the Lac operon in bacteria (1961). The fundamental feature here is the repression and derepression of the genes by chemical signal substances from the cytoplasm.[9] For their controlling function on transcription into messenger RNA specific threshold concentrations are essential and are gauged by regulatory enzymes which, at the same time, recognize the steric configuration of the specific signals.[10] Here, again, we have the relay principle of mutual exclusiveness characteristic of trigger effects (Monod).

The repressor model is accepted, in principle, as being valid also in higher organisms though there are indications that at least *in vertebrates the antagonism of mutual exclusion is replaced or* supplemented by a mechanism of balanced co-operation in which certain metabolites of the cell's own chemical machinery, such as hormones,[11] play a key rôle as inducers in the Jacob-Monod model. This ensures a control, exercised on the individual cell, by the whole organism. At the same time, it indicates a determinism of higher rank.

It is this kind of determinism[12] which makes the organism a functionally autonomous unit. This unit can be subjected to strict causal analysis only by isolating parts of it. The isolation is, at the same time, indispensible as it is responsible for annihilating exactly the kind of mutual interdependence between the various parts characterizing living beings.

Darlington stated in 1958:

> In fact we may say that it is not the environment which changes the genes but the very opposite: it is the genes which change the environment. In adaptation every gene change demands others to act in concert with it.

By reversing this plain truth the doctrine of environmental theory in its self-righteousness has become a sad but essential

[9] B. I. Balinsky, "Control of Gene Action During Development," *South African Medical Journal,* Vol. 46, 1972, p. 1805.

[10] J.-P. Changeux, "The Control of Biochemical Reactions," *Scientific American,* Vol. 212, No. 4, 1965, p. 36.

[11] D. Hess in a Paper in *Genetik,* 1972, p. 117.

[12] F. Jacob, *La Logique du Vivant,* Editions Gallimard, Paris, 1970; German translation *Die Logik des Lebenden,* S. Fischer, Frankurt am Main, 1972, p. 200.

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feature of our time, now bent upon man controlled by social (and perhaps genetic) engineering and upon a deceitful One-Worldism.

On a related plane, the "Decline of the West" reveals itself in what Simpson, one of the fathers of neo-Darwinian theory calls, in his *Meaning of Evolution,* the "present chaotic stage of humanity." In the same essay he emphasizes that scientists at last have succeeded in exposing the sham of a meaningful universe. He calls it a childish dream. Thus we face, as the Summa Theologiae of modern evolutionary theory, a chaotic mankind in a meaningless world. It seems somewhat juvenile to deplore the first and hail the latter. To redress the present chaos, Simpson suggests a better quality democracy and responsible human knowledge. This rests on the false assumption that "a man's racial characteristics can be altered either at once, or even in a few generations" as L. S. B. Leakey,[13] the discoverer of Olduvai Man, stated in his lectures in Oxford and Birmingham.

This fallacy is very close to the environmentalist's heart. It has a strong Lamarckian flavour as it is shown by the untiring efforts, made by the propagators of milieu theory, to deny or, at least, to minimize the importance of Mendelian factors in cultural evolution. Thus Simpson states that man's "reactions depend far less than other organisms on physically inherited factors, far more on learning and on perception of immediate and of new situations." Cultural diversity is, for Simpson, "within the reaction range of an established mechanism," and he goes on to say that "there is no definite evidence that these variations are genetically controlled."[14] Simpson here refers to M. Mead who conceives culture as "the systematic body of learned behavior characteristic of the members of a society."[15] There are those who hold the view that any culture springs from the work of a genius whose very stigma it is to behave differently from the members of his society.

Opposing views are anathemized as evidence of effrontery and ignorance by the environmental dogmatists.[16] We are indeed living in a period of history not unlike that of Giordano Bruno and Galileo Galilei as is testified in their Resolution by world-famous geneticists published in *The American Psychologist,* July

[13] L. S. B. Leakey, "The Progress and Evolution of Man in Africa," lectures at Oxford and Birmingham, 1961.

[14] Anne Roe and G. G. Simpson (editors), *Behavior and Evolution,* Yale University Press, New Haven, 1958, p. 534.

[15] M. Mead, "Psychiatry and Ethnology," *Psychiatrie der Gegenwart,* Band III, 1961, p. 452ff. Mead reviews the use of culture and personality studies as carried out in the pre-war period and during the Second World War. It is amazing to learn from her that "a large section of these wartime studies was devoted to the purposes of psychological warfare (United States Office of Strategic Services Assessment Staff, 1948)."

[16] G. Heberer, *Was heisst heute Darwinismus?,* Göttingen, 1960, p. 8.

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1972—"Men to whom has been given the courage to teach the truth as they see it are being denied the right to propagate their views. However, in the end the truth will prevail."[17]

I

THE DILEMMA

Were the eye not attuned to the sun,
The sun could never be seen by it.

Goethe[18]

Why does the selective theory of evolution start with a postulate—forever undemonstrable, for it would mean proving a non-existence—and plunge at once into a "fundamental dilemma"? Because the postulate entails the dilemma.

G. G. Simpson rejects the sequence from dogfish to frog, cat and man as "evolutionary," i.e. historical; according to him, it is a logical sequence, maybe not related to a true historical series. However, in explaining the critical transitions, "whenever a way of life is changing in the course of evolution," he invokes what he calls historical causation, "which includes everything that has ever happened."

This brings us to the central concept of selectionism, causality. H. Helmholtz,[19] a staunch empiricist, writes in his *Optik:* "The causal law has the character of a purely logical law also essentially in that the conclusions drawn from it do not concern real experience but its understanding, and, therefore, in that it cannot be falsified by any possible experience." By projecting the logical relationship of sequitur into an "objective" world it becomes a cause-and-effect relationship. With it, the problem of precedence, that is of temporal and causal priority arises. This problem flows from the plausible illusion that the objects of the external world are the necessary and sufficient causes of our sensory perceptions.[20] This, in its turn, gives rise to what A. N. Whitehead has termed the "fallacy of misplaced concreteness.[21] We then have a situation characterized by W. G. Gallie by stating that *"everything* is assumed that needs to be assumed to get our alleged explanation to do its appointed work." Gallie calls this spurious sufficiency

[17] R. Gayre of Gayre in a letter to the *Springer Verlag,* Heidelberg, February 1974.

[18] N. R. Hanson, *Patterns of Discovery,* Cambridge University Press, Cambridge, 1961, p. 4.

[19] P. Mittelstaedt, *Philosophische Probleme der Modernen Physik,* Bibliographisches Institut AG, Mannheim, 1972, p. 148.

[20] E. Schrödinger, *What is Life? Mind and Matter,* Cambridge University Press, Cambridge, 1967, p. 157.

[21] A. N. Whitehead, *Science and the Modern World,* Macmillan, New York, 1925. German translation *Wissenschaft und moderne Welt,* Zurich, 1949, p. 66.

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explanation "the genetic fallacy par excellence" (Gallie's emphasis). It applies equally to the giraffe's neck, the cat's crooked claws and the pre-adaptive mechanical strength of the crossopterygian fin which gives those fishes best able to walk a chance to leave more descendants (Simpson).

The genetic fallacy means that the Sufficiency Postulate cannot explain evolution but it explains the futility of the Darwinists' untiring search for the ancestral forms and/or the missing links. These are either not there or remain conjectural. To quote from Simpson's *Tempo and Mode in Evolution*: "This regular absence of transitional forms is not confined to mammals, but is an almost universal phenomenon, as has long been noted by palaeontologists. It is true of almost all orders of all classes of animals, both vertebrate and invertebrate. *A fortiori,* it is also true of the classes, themselves, and of the major animal phyla, and it is apparently also true of analogous categories of plants. "With regard to the paragon of divergent evolution by natural selection, the equidae, Simpson states that "nowhere in the world has any recognizable trace been found of an animal that would close the considerable structural gap between *Hyracotherium (Eohippus)* and the most likely ancestral order, the *Condylarthra.*"[22]

The orthodox selectionist's view, resting on the concept of nature's objectivity, apart from being unable to explain the historical route evolution has taken[23] or to predict its future course, in addition, by its dualist stand, confronts its followers with a host of mutual alternatives or dichotomies.

The more prominent ones are the following: (1) "At random," meaning absence of environmental causation, as against "environment-dependent." By this, "selected," i.e. brought about by the environment in terms of favourable gene complexes (ensuring reproductive advantage), becomes synonymous with "adaptive." The contradictory opposite, i.e. "environment-independent," becomes identical with "occurring at random." Pre-adaptation and reproduction are both not necessarily, and not usually, independent of environment though random pre-adaptation (that is structure or function coming into existence prior to their use) "does exist and has a definite rôle in evolution" (Simpson). Consequently, most processes inherent in the genetic mechanism of evolution occur at random.[24] (2) Additive[25]

[22] G. G. Simpson, *Tempo and Mode in Evolution,* Columbia University Press, 1944, p. 106.

[23] M. Eigen, "Selforganization of Matter and the Evolution of Biological Macromolecules," *Die Naturwissenschaften,* Vol. 10, 1971, pp. 503, 515. In his foreword to the German translation of Monod's *Chance and Necessity,* Eigen says that he is horrified by the dogmatic stand of the Objectivity postulate.

[24] Anne Roe and G. G. Simpson, *op. cit.*, p. 16.

[25] G. Heberer, *Theorie der additiven Typogenese,* Gustav Fischer, Stuttgart, 1954-59.

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modification of what already exists, as against "absolute newness," i.e. essential uncertainty in evolution, the latter being creation, not revelation (Monod). (3) Explanation on a purely physical plane, that is in materialistic-mechanistic terms involving a blind and automatic force which pushes from behind (Huxley, 1956), as against vitalism or metaphysics; or again: chance as against a divine fiat.

The strictly deterministic character of the Darwinian chain as the only and sufficient explanatory principle in evolution is clearly revealed in Simpson's dictum that "the organism is adapted to the environment and not *vice versa*."[26] It is paralleled by the behavioural chain correlating the organ (that must already exist and is determined altogether by heredity) with modification of behaviour by "learning" (in a broad sense). It is of minor importance whether behavioural modification starts from a blank state-organism or from the premise of congruence between the gene and the dissected behaviour. Whatever the interpretation, it implies an artificial distinction, and a causal and temporal priority relationship between the organ and its function,[27] analogous to that between the egg and the hen.

The regressus *ad infintum,* implied by the causal chain, is, in the case of Darwinian causation, arbitrarily cut short, at the one end, by the assumption of a "gene chaos,"[28] and, at the other, by the postulate of niche specificity, when "each species has its niche, and each niche is occupied by only one species."[29] The first is a product of its inventor's imagination, and the second marks the end of the selectionist's explanatory power, but not the end of evolution. At this critical point, Simpson invokes a new principle, namely expansion and diversification, as "the main motifs of the rich fabric of life's history."[30]

This amounts to replacing a so-called finalistic explanation (or prestabilized harmony) by a different mystical teleology. One is reminded of the story about God and Immanuel Kant as it is told by Bertrand Russell: hardly, says Russell, had Kant locked Him out, he let Him in again by the back door.

Even so uncompromising an empiricist as Bertrand Russell comes, at the end of his *Inquiry into Meaning and Truth* to the conclusion that a complete metaphysical agnosticism is incompatible with the maintenance of linguistic propositions. Though language is an empirical phenomenon propositions about the world reveal something about the structure of the world, not only about syntax. The genetic code can be read only by its own

[26] Anne Roe and G. G. Simpson, *op. cit.*, p. 520.

[27] E. Schrödinger, *op. cit.*, p. 121.

[28] G. Heberer, *Was heisst heute Darwinismus?, op. cit.*, p. 33.

[29] Anne Roe and G. G. Simpson, *op. cit.*, p. 523.

[30] Anne Roe and G. G. Simpson, *op. cit.*, p. 25.

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product[31] which, in its turn, modifies the code. This mutual interdependence within a closed circuit disposes, at the same time, with the limitations of the Darwinian causal sequence and the priority puzzle of hen and egg. Least, a godly fiat needs being invoked. Life and evolution are their own purpose. The search for an outside "purpose" or a predetermined end either of mankind or the universe is implied by, and an outgrowth of, the cause-and-effect relationship which, as we have seen, is inadequate to explain the meaning of biological phenomena such as evolution because it involves, in its turn, a fallacious dichotomy. It is mainly for reasons of linguistic abstractness that this dichotomy is turning up in scientific discussion. As E. Schrödinger has emphasized, it is an artificial distinction to regard the possession of an organ and the urge to use it and to increase its skill by practice, as two different characteristics of the organism.[32]

Here the reader with a working knowledge of German is referred to E. G. Kolbenheyer's autobiography[33] from which we quote the discourse between Karst and Death.

Tod: Spiel aus den Geist, die Menschenherrlichkeit,
Als sei Dir, wenn Du weisst: wann und woher—
Auch das Wozu des Lebens offenbart.

Karst: Leben erübrigt das Wozu—es ist.

Tod: Und wenn es nicht mehr hängt im Schöpfungsring,
Der aus der Urwelt undurchbrochnen Laufs
sich ewig neu verjüngt? Was ist es dann
In der Planetenstunde?

Karst: Urentbunden
Im Zeugungskreis der Liebe. Dem Verhängnis
Des Daseins rückverjüngt, lebt allumfangen
Und allentäussert aus die Lebensart
Sich selbst, im Wuchs und Wirken ihres Wesens
Ziellos bewegt in ewiger Entwicklung.

II

RANDOMNESS, REDUNDANCY, CONTINGENCY

> We would like to think ourselves necessary, inevitable, ordained from all eternity. All religions, nearly all philosophies, and even a part of science testify to the unwearing, heroic efforts of mankind desperately denying its own contingency.
>
> J. Monod.

The environmentalist's definition of randomness is *per negationem:* absence of environmental instruction (see above).

[31] F. Jacob, *La logique du vivant, op. cit., Die Logik des Lebenden, op. cit.,* p. 316.

[32] E. Schrödinger, *op. cit.,* p. 121.

[33] E. G. Kolbenheyer, *Sebastien Karst, Uber sein Leben und sein Zeit,* III Teil, Darmstadt, 1958, p. 533.

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Monod distinguishes operational from essential uncertainty, the latter being an intersection or coincidence of two wholly independent causal chains.

In order to describe the mechanism of genetic transmission and its random "errors," randomness is more adequately described in terms of redundancy as developed in information theory. Zero randomness then means that in a sequence of events, knowledge of any part of the sequence has no predictive value. At the other end of the scale, 100 per cent redundancy means that if a critical part of the sequence is known the whole sequence can be predicted. In other words: the higher the redundancy the less is the amount of information conveyed, and conversely: the less the redundancy the more unpredictable is the future of the system. Redundancy and scarcity of information, that is, randomness, are indirectly proportional (Brillouin).

It follows that randomness is not an alternative but a graded continuum. This implies that in a sequence of events such as occur in the replication of the genetic message the two coinciding causal chains, namely the intra-organismic and the environmental, are not absolutely independent of each other as postulated by Monod—though "singularities" may occur within either sequence. This indicates that the genetic mechanism inherent in the evolutionary sequence cannot be adequately described either in terms of "essential uncertainty" alone or in terms of the genome being shaped, step by step, along adaptive lines by an environment selecting and favouring certain gene complexes and destroying the others. This involves the concept of contingency, rather than necessity, as the dominant feature in evolution. It makes evolution, at the same time, indeterminate, but inevitable (Eigen) and irrevocable.

This view is at variance with orthodox environmental theory which equates evolution and selective pressure exercised by the environment on the organisms. As an example take the "typical natural selection" involved in the transition from the crossopterygian fin to tetrapod limb. Fishes began to walk because those that could walk when streams were drying up had a better chance of reaching water to breed in and to leave more descendants as compared to those who could not walk (Simpson). In the same vein, the leading genetic theorist, J. Huxley, says of the duck-billed platypus, *Ornithorhynchus:* "It is a survivor of a type halfway between a reptile and a modern mammal. It has managed to survive in the Australian region for seventy million years or more because it was isolated from competition with the more efficient higher mammals."

For brevity, we shall, in the present discussion, indicate selective advantage in the explicans with p; it is, respectively, the ability to walk and the absence of competitors; q then will stand

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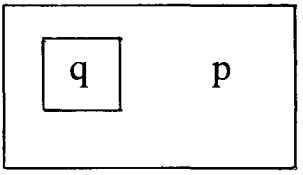
for the explicandum, that is, survival in either case. The "because" in the above passages can be interpreted in two ways: (1) as an implication, meaning: whenever p, then q, or: no q without p. In this case, p is a necessary but not sufficient condition of q, in diagrammatic representation:



q is sufficient for p or a "criterium" for p, but not conversely, since some ps are not q. (2) as an identity or definition—if and only if the two areas coincide. This means: no p without q, and conversely: then p is a necessary and sufficient condition for q.

The sufficiency postulate of selective theory means interpretation (2): evolution is defined in terms of natural selection and *nothing else*. More explicitly: no evolution without adaptation (the result of natural selection), and no adaptation except under environmental pressure.

Returning now to our original examples we can formulate the following corollary: in terms of selective theory, increase in the mechanical strength of the fin to make it an efficient walking device was the *only*, i.e. the necessary *and sufficient* means for the crossopterygians to evolve into land animals. Expressed in the form of a question, the corollary runs as follows: the platypus, if forced to compete with more efficient mammals, could it have developed ways and means enabling it to compete successfully and hence evade extinction? Or again: could the giraffe have "invented" a different way of adjustment, such as by getting adjusted to a kind of food obtainable without stretching unduly its neck?

These questions are answered in the negative by selective theory. According to this theory, the path evolution has actually taken was the only one it could take. Evolution as a whole and down to the last detail was a necessity right from the start and throughout its course as there was no other possible way for life to expand on the earth. As things stood, the organisms had no choice—either to adjust themselves in exactly the way they did or to become extinct. It is the definition of necessity and sufficiency as understood by the environmentalists that is at the base of their causal-mechanistic explanation of evolution.

It is obvious that, in the case of man, a drastic turn-around was needed in order to save man's "unique status" (Simpson) within the animal kingdom. This could be done only by making man a subject of a "new form of evolution overlying and largely

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dominating the old, organic evolution." This new, exclusively human, evolution involves nothing less than abandoning, to a large extent, the materialistic principle of explanation in purely physical terms, adopted and held valid, to the exclusion of anything else, throughout the so-called ordinary or Darwinian evolution. This amounts to pushing aside the physically inherited Mendelian factors of inheritance and bringing into the foreground, instead, learning or inheritance of knowledge, in other words, universal educability as the unique and species-specific character of humanity—another "heroic effort of mankind denying desperately its own contingency" (Monod).

III

ORDER FROM DISORDER

> The operation of natural selection cannot be regarded as the result of chance; on the contrary, it is rigorously determined by multiple conditions which, although more complex than the laws which govern the movement of the heavenly bodies, are no less exact.
>
> Sir Gavin de Beer

It is what is commonly called "mutations" in a very broad sense of the word that provide the raw material of evolution by supplementing and balancing the variability in a species; for the latter is a self-limiting process "that can not proceed beyond about the specific level" (Simpson). Mutations then provide that immense range of types available for natural selection, and also the individual members of a favourable gene-combination (E. B. Ford) which Sir Gavin has in mind when referring to "multiple conditions" in the above statement.

The guiding idea is the production of order or regularity out of disorder or irregularity. The paragons of such a process are the laws of thermodynamics that express the average behaviour of an enormous assembly of particles in random movements and collisions as exemplified by an ideal gas in an enclosure of finite dimensions. Under these circumstances, the average velocity of the particles and the average distance covered between two collisions can be determined and expressed in mathematical form. Now, for complete order—meaning average behaviour—to result from disorder, disorder must be complete. This means that, with regard to statistical fluctuations in the behaviour of a large number of individual elements, a probability distribution must exist complying with the law of great numbers; more explicitly, the average must coincide with the most probable occurrences (L. Brillouin). Only, if in an assembly of radioactive atoms the chance to blow up for each atom remains the same throughout its lifetime, the exponential law of radioactive decay will hold.

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We intend to show that the above condition *sine qua non* for creating law out of chance, by a process "wholly mechanistic in its operation" (Simpson) is not fulfilled in the case of "mutations" providing the building blocks of evolution. This implies rejection or modification of the tenet of ironclad necessity invoked by the synthetic theory of evolution. The "creative" force of natural selection does not work with a completely disordered state of events to produce laws analogous to those "governing the movement of heavenly bodies."

It is a significant fact that mutation rates throughout living organisms, from tree to fruit-fly to man, are rather constant and in the vicinity of 10^{-5} per generation. This means that in a population of 500 one mutation will occur in 200 generations. Heberer has pointed out that in Drosophila a gene remains constant in the average over 1,000 generations, and in man, the genetic invariance is a multiple of this figure.

The low frequency of these kind of events testifies to the conservativism of the genetic apparatus, and is related to the fact that the overwhelming majority of the so-called spontaneous mutations are known to have deleterious or even lethal effects. Nevertheless, Monod has estimated that in the present-day human population of nearly 3.10^9 individuals there occur some 10^{11} "mutations" with each generation. At first sight, this seems an enormous figure. However, comparing it with the number of genes and the information capacity contained in biological macromolecules, the figure almost dwindles away. If n is the number of digits in a DNA chain to the base b (e.g. b=20 Amino acids), then for a chain length n=100, there will be $b_n=10^{130}$ possible sequences (Eigen) representing the information capacity of a comparatively short chain. It is obvious that even during time periods on an evolutionary scale only a comparatively minor proportion of such singularities can come into existence.

To this class of individual accidental alterations belong many instances of the easily detectable genetic infirmities in man, such as Garrod's "inborn errors of metabolism," the haemoglobinopathies and the like, that make up the subject-matter of medical genetics. Their incidence falls also within the range of 10^{-4} to 10^{-5}. They are chiefly due to "flaws" in the DNA pattern or defects in a structural gene.

Of much greater importance for evolution than "point" mutations are those alterations of the genetic assemblage associated, in all higher organisms, with bisexual reproduction. It is the resulting vast reservoir of gene recombinations, that Monod calls "individually undetectable mutations," which may produce significant effects.

During the classical period of Mendelian genetics, the rigorous environmental causation resulting in favourable gene complexes

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(and destruction of the injurious) seemed firmly established. It was thought, obviously under the influence of quantum theory and the pioneering work on mutations by H. de Vries (whose "classic" appeared two years after Planck's original paper) that anything that happened in the genome was a true quantal event (as expressed in H. J. Muller's phrase that the quanta of physics become the quanta of evolution, 1935). Consequently, it was common consensus that any agency influencing the rate or nature of mutations was hypothetical or did not work (R.A. Fisher, 1932).

It is at the very heart of Darwinian genetics that natural selection can produce only results "which are of immediate biological utility to the species" (J. S. Huxley, 1954). To this line of thinking the concept of evolution of the genetic systems or of the karyotype has brought a somewhat drastic change.

The fundamental idea of "internal rearrangements" within the genome, such as genetic changes occurring in complete ignorance of what is going on outside the cell, was born when R. R. Gates in 1928, in his final description of Oenothera cytology, drew attention to the end-to-end association of chromosomes in diakinesis and metaphase of meiosis of this genus which may involve the whole diploid set of chromosomes to form a ring. The phenomenon had previously been considered as an alternative form of pairing or telosynapsis. It is now called segmental interchange or reciprocal translocation, meaning an exchange of broken halves of two non-homologous chromosomes creating an effective sterility barrier (Ohno). It was found recently by C. Wallace and N. Fairall in South Africa that the karyotype of the warthog is explicable on the assumption of such reciprocal translocation between the pairs of chromosomes which are missing in this animal as compared to the karyotype of the pig. The same mode of chromosome evolution was described in 1963 by J. L. Hamerton and his co-workers in the hominoidea where the translocation is between acrocentric chromosomes to form a metacentric chromosome thus reducing the chromosome number by one. This kind of centric fusion of two acrocentrics has been known since 1916 as Robertsonian fusion. It is now under detailed study in the family Bovidae in the Kruger National Park in the Transvaal. It is there where C. Wallace and N. Fairall found a successive series of acrocentric fusions starting from the ancestral karyotype of 60 chromosomes in the impala through the blue wildebeest (58), the buffalo (52), waterbuck (50), and the kudu (32), down to the steenbuck with a diploid number of 30.

An equally important mode of chromosome evolution is produced by two breaks within the same chromosome, the fragment being reinserted after a 180° turn. If such an "inversion" contains the centromere—so-called pericentric

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inversion—a one-armed acrocentric chromosome is changed into a two-armed metacentric, and *vice versa,* or, again, the two arms of a chromosome can be interchanged.

It is clear that such drastic changes involving whole chromosome segments, their number and internal structure, can play their rôle in the evolution of species only if certain parts of the genome become temporarily or permanently inactivated by heterochromatinization, that is incorporation into the genome of inert genes or at least such genes with non-specific determinants carrying with them no harmful effects; this will ensure the gametogenesis still balanced to such extent as to produce a viable zygote, and, at the same time, stabilize the heterozygous advantage as a new species characteristic by incorporation of two alleles into the genome as two separate gene loci (Ohno) so that the production of a lethal homozygote is precluded.

In the Kruger Park so far no abnormal individuals among the Bovidae (kudu and impala) have been reported, and the carriers of the genotypic abnormalities did not differ, with regard to their appearance and behaviour, from the common average. Apparently, this kind of breakage and rearrangement in the genome is associated with substantial shifts in the size and location of heterochromatic segments, that is condensed masses of DNA, "rendered genetically empty" (Ohno) or inert; such "blanks" are neutral relative to the environment. How much is contributed to such processes by various degrees of inbreeding and discriminative mating is a matter of speculation. However, it is obvious that we encounter here the basic mechanism of genetic isolation as emphasized by C. D. Darlington and, with it, of the splitting into smaller groups.

The "singularity" of these events does not rest merely in what happens to the two- and one-stranded sorts of nucleic acids; it concerns equally well the behaviour of most allosteric enzymes instrumental in the extra-nuclear (cytoplasmatic) control of gene activity as shown in the Jacob-Monod Lac operon, and suggested as the basis of gene control in higher organisms as well (C. F. Albrecht). These regulatory enzymes require for their response certain threshold concentrations, reminiscent of those used in electronic relays (J.-P. Changeux). Unlike ordinary "classic" enzymes, the allosteric proteins respond with what Monod calls threshold effects. These "triggers," of course, are part of the cell's own metabolic machinery which, in its turn, is under chemical (hormonal) and nervous control. Thus, a whole string of correlated, mutually interdependent events now unfolds itself in the details of karyotypic or chromosome evolution, based, on the one hand, on genetic redundancy and, on the other, on genetically blank or neutral gene loci capable of being transmitted to the offspring. Evolution at the molecular level following its own

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chemical lines of affinity results in chromosome polymorphism of an extent formerly not appreciated. It has replaced the classic idea of a pearl string of chance events, independent of each other, inherent in Darwin's original conception of "accumulation by chance" (E. Schrödinger) and revived in the neo-Darwinistic "series of progressive mutations."

In this view, natural selection is not any more the composer of progressive gene complexes or the mediator of genetic changes; on the contrary, it is the conservative function of natural selection which stabilizes the status quo in the genome by not allowing the basic characters of a gene to be changed unnecessarily.

To sum up: Gene recombinations associated with sexual reproduction, including selective mating and breeding habits and structure, are not chance events in the quantum physical sense, nor the result of a mere reshuffling within a given multiplicity of conditions in terms of probabilistic thermodynamics. The "singular" events forming the body of evolution at the molecular level may remain "individually undetectable" by failing to offer immediate selective advantage. However, by putting at the disposal a vast and "internally" selected redundancy surplus of dormant or inert segments of the genome they form part and parcel of the genetic store of the species and open up avenues for environmental opportunities and challenges which may turn up in a distant future, thus securing ultimate survival. This kind of "internal selection", though invisible to the ephemeric observer, nevertheless outlines the vista of an autonomy of the living beings which C. D. Darlington has called "initiative and foresight."

IV

ONTOGENY AND PHYLOGENY

> The origin and lineage of the whole biosphere are reflected in the ontogenisis of a functional protein. And the ultimate source of the project that living beings represent, pursue and accomplish is revealed in this message—in this neat, exact, but essentially undecipherable text formed by primary structure.
>
> J. Monod

The Jacob-Monod model of cytoplasmic control of gene activity rests on a dichotomy between ontogenesis and phylogenesis: epigenetic or embryonic development, a revelation or unfolding of nature's hidden designs, as opposed to evolution, that is, creation of absolute newness. Epigenesis flows from gratuity or arbitrariness by which the teleonomic project is accomplished, a unique feature of allosteric interactions and the ultimate source of autonomy or self-determination characterizing

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living beings in their behaviour. Evolution flows from a coincidence of causally unrelated chains of events.

This model has certain limitations. It comes from observations in unicellular prokaryotes and, as yet, has not been confirmed in higher eukaryotes though it can be concluded *per analogiam* that, in these, similar mechanisms do exist; but up to now, not a single gene has been found to be repressed or de-repressed in vitro by a specific molecule in higher organisms (C. F. Albrecht, 1972).

Conclusions as to differentiation and evolution drawn from the model also must be viewed with reserve. Bacteria do not differentiate and evolve in the ordinary sense of these terms. In multicellulars, communication between the cells, that is information transfer from cell to cell, becomes of vital importance for co-operation and synchronisation. It is effected by hormonal and neural control, both absent in bacteria. Genetic information to be effective, requires generations; chemical and neuroendocrine communication may be a matter of milliseconds (G. S. Stent).

The antagonism between inducers and repressors derived from the Lac operon model becomes much more complicated in higher organisms where hormones act as inducers (or co-repressors) albeit by an intermediate such as cyclic AMP. The same applies to enzymes whose production is controlled by a hormone, or even to simple end products of a metabolic chain, such as amino acids acting as messengers: here, mutual exclusiveness is replaced by a delicate co-operative equilibrium.

Another characteristic feature of extranuclear control in higher organisms is its trigger mechanism reminiscent of the "all or none" phenomenon of allosteric interactions in bacteria. The nature of these chemical "signals" emerging from the "milieu intérieur" and reaching the genome to repress or de-repress transcription into messenger RNA, is still hypothetical in multicellulars. B. I. Balinsky in Johannesburg has suggested that the genome may be especially receptive at certain times, for example, when the two DNA strands are separated during chromosome reduplication.

In eukaryotes, phosphorylated acidic proteins are supposed to act as controllers by exposing specific DNA segments for the attachment of RNA polymerase (C. F. Albrecht).

It was one of Monod's co-workers who pointed out that the signalling mechanism is a common feature in biochemical as well as in neuronal control: Nerve cells react only if the signal has reached a certain threshold level (J.-P. Changeux). For this reason, it justifies special discussion. We shall use a model due to E. Schrödinger (1929).

Suppose we have a light wave hitting a particle at K. We ask: What must be the shape of the wave in order to cause a photo-chemical reaction in K? According to the classical view, the

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energy along the path of the wave will have to add up and reach, eventually, the level required to set up and keep going the process of disintegration during the whole interval of its duration. This means that the accumulated energy built up before reaching K will subsequently be spent during the time of the photo-chemical reaction. But this is not the case as is shown by the quantum theoretical interpretation. Whether the event in K will occur or not depends solely on whether at any point along the light path the energy reaches a critical level or not; for the rest, the shape and length of the wave before reaching K is wholly irrelevant. It is a singular energy level which is needed to trigger off the chain reaction at K; this, once set in motion, needs no additional energy supply, in other words: the threshold energy is spent for the "trigger" and nothing else.

We will need this interpretation in what follows. In higher organisms, plants and animals alike, the timing and the rate of responses become of vital importance. In ontogenesis, the net result of quantitative change in the rate is retardation or acceleration, a well-known example being precocious maturity, that is, hastening of function of the reproductive glands. Now, phylogenesis is due to modified ontogenesis, modification being brought about by heritable changes. Thus, altered rates occurring in successive ontogenies, will give rise to a phenomenon called heterochrony, that means novel situations arising at any stage of individual development and transmitted from parent to offspring (G. R. de Beer).

Timing and synchronisation as a function of certain hormones can clearly be seen in metamorphosis, for example in the silk worm, the larva of the cecropia moth. A whole string of hormones is involved, with a dozen ganglion cells as the top conductor of the whole orchestra synchronizing the life history of the developing moth with the seasons. Towards the end of the larval stage the precursors of the adult animal, nests of embryonic cells, called "imaginal discs" are released from the biochemical restraint exerted on them by the "juvenile hormone," and respond to the prothoracic hormone by being transformed into the pupal organs and the structure of the adult fly. Each subsequent developmental stage coincides with the withdrawal of a hormone and its restraining effect on another—reminiscent of Monod's "double negation" in the Lac operon system. "We cannot yet pretend," says Carrol M. Williams, "to understand the earlier mechanisms whereby the cells are made servant to the distant goals of the organism as a whole. For though each cell is equipped with a blueprint of the total organism, its fate is decided by influences that are the common property of the entire growing system."

It may be pointed out here that Simpson, in his theory of

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Quantum Evolution (1944) invokes a similar threshold principle triggering, according to him, the initial stage of this particular mode in evolution. Simpson believes quantum evolution to be "the dominant and most essential process in the origin of taxonomic units of relatively high rank, such as families, orders, and classes." It seems somewhat arbitrary to pick up increase in mechanical strength of the crossopterygian fin as the dominant, therefore pre-adaptive, feature in the transition to the tetrapod limb. The transformation of the tadpole into the frog recapitulates not only in structure and function but also at the biochemical and molecular levels the evolution from fish to terrestrial animal. To the transformation of the Devonian lobe-fin Eusthenopteron, an ancestral amphibian, applies equally to what Simpson says of the archaeopteryx—"that the most crucial part was already accomplished."

In Monod's view, epigenesis is an intra-organismic chain of events of hidden designs enclosed in the genetic message and disclosed in the teleonomic structures and performances by which living beings become autonomous and self-determined in their behaviour as functional units. It is obvious, then, that this message must contain much more than detailed instructions as to the synthesis of different proteins.

It is a sudden change in behaviour which is triggered off by a sudden change in the "milieu intérieur" at the critical turns in metamorphosis as well as in evolution. It results in a changed relationship—changed on the side of the organism—towards the environment. Whereas metamorphosis takes place along a plan rigidly determined by past information stored in the species' gene pool, evolution progresses by exposing the new function or achievement to environmental pressure—sometimes called "post-adaptive"—for continuous and detailed perfection. The archaeopteryx, though anatomically still a reptile, was, regarding its ability to fly by means of feathers, a true bird: it was not a reptile challenged by its environment to learn to fly. "The urge to fly was there before the wings were developed" (N. Tinbergen).

In the peppered moth *Biston betularia L.*, the single gene locus (or a closely linked locus) responsible for the black colour of the wings at the same time arouses the animal to a change in some concordant physiological and behavioural traits as well, for instance in mating preference, precipitous maturation of the caterpillars, degree of hardiness and the like (Kettlewell). This accounts for the fact that the light wild form has not become extinct in the sooty industrialized surroundings but has established an ecological equilibrium with the mutant carbonaria. To explain this kind of genetic polymorphism as an instance of pleiotropy would mean an explanation, *a posteriori* or begging the question. It is evident that many ways of adjustment are at the

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organism's disposal to "choose" among them. The situation was adequately described by E. G. Kolbenheyer (1935) who stated that though adaptation is demanded by the environment it is executed by the living being. A species then would not become extinct because it failed to "hit upon" a specific mode of adjustment but because all available modes have become exhausted.

Indeed, the environmental impact, the "nudge," is not the creator of the organism's "readiness" to respond. The faculty of a meaningful response is a creation of genetic information in store, including the "silent" information associated with chromosomal evolution, that is, in the absence of environmental instruction. This is contrary to the idea of an "inner urge," called entelechy or vitalistic, as envisaged by optimistic idealists from Spencer to Driesch, and Bergson's "évolution créatrice" to Teilhard's "point Omega."

However, it is akin to K. E. von Baer's view that the organism, on account of its affinity to a parent stock, is adjusted, in broad lines, and thus capable of surviving in an environment not radically different from that to which the progenitors were adjusted. In contrast, Darwinian causation (Heberer's "Kausierung der Gesamtphylogenie") requires that the organism should live and reproduce in order to become adjusted. Von Baer's "law of embryonic resemblance"[34] became later known as the Wallace and Darwin "law of succession" which states that each species came into existence coincident, in time and space, with a closely allied species.

The Nobel-laureate H. Spemann[35] concludes his pioneering work on embryonic development with the following remark:

> Again and again, expressions have been used that indicate no physical but psychic analogies. That we have done so means that we had in mind something more than just a poetical metaphor. What is meant is that the local response of a germinal piece of tissue endowed, as it is, with the most differing potentialities, in an embryonic "field," that is, its behaviour in a definite "situation", does involve no ordinary reactions of simple or complicated character. We intend to mean that these developmental processes, like all life processes, in the way of their inter-relationship have the greatest similarity to those occurrences of which we have the most intimate knowledge, that is, the psychic phenomena.

[34] K. E. von Baer, *Uber Entwicklungsgeschichte der Tiere. Beobachtung und Reflexion*, Königsberg, 1828. From G. R. De Beer, *Embryology and Evolution*, Oxford, 1930, p. 109.

[35] H. Spemann, *Experimentelle Beiträge zu einer Theorie der Entwicklung*, Julius Springer, Berlin, 1936, p. 278.

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And this is quite independent of whether those processes will be reduced one day to, or built up from, physico-chemical phenomena.

V

THE KINGDOM OF THE SPIRIT AND THE DIVISION OF THE WORLD

> Besides the two channels represented (a) by the adaptive processes of evolution, and (b) by individual acquisition of information, no third possibility exists for information being "fed into" the organic system.
>
> K. Lorenz

The above dictum by the Nobel laureate Lorenz (1965) implies that all information reaching the organism issues from outside;[36] hence, the organism responds only when "fed into." Without input no output. The implication is threefold: it concerns the objectivity of the outside world, the sufficiency stand of selective theory, and the priority of invariance in relation to teleonomy as discussed earlier. Moreover, Lorenz's statement endorses Simpson's irreciprocity principle stating that "the organism is adapted to the environment and not *vice versa*." Therefore, it is appropriate to start from here on our final issue, a synopsis of the points raised in the preceding sections.

The objectivity postulate arises, as we have seen, from a *consequential* principle of logic misplaced into the concrete real external world to engender, in the latter, the *sequential* (temporal or historical) relationship between cause and effect. According to dialectical materialism, the external world must be literally presented to consciousness (Monod), human thought being a perfect mirror of it (J. B. S. Haldane). This again presupposes an objectively given world, and the social process going on in it, creating consciousness.[37] Were it otherwise, the mirror would be its own mirror-image, and the Marxist doctrine would result in an infinite regress. This shows that dialectical materialism does not scratch the objectivity of Nature but presupposes it. It is its "materialistic" core.

The objectivity postulate involves a threefold dichotomy of mutual exclusiveness: (1) The observer as opposed to the Ding an sich—the thing or phenomenon in itself; (2) Epigenesis as opposed to evolution as absolute creation; (3) Gratuity as opposed to necessity arising from uncertainty, defined as intersection of

[36] In his latest work, *Die Ruckseite des Spiegels*, Piper Verlag, München, 1973, Lorenz again distinguishes between the perceiving subject and the "real external world."

[37] C. Morgan, *Liberties of the Mind*, Macmillan, London, 1952, p. 51.

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two unrelated causal chains. If objectivity is consubstantial with science and accepted as an article of faith it defeats its own argument. There are no two wholly unrelated causal chains in the Universe, or, if they are, we are unable to verify (or falsify) their existence (Gödel). The situation is analogous to that in complete metaphysical agnosticism (Bertrand Russell).

Everybody will accept what Simpson says when referring to the typical case of natural selection which turned fishes into land animals: selection is a conditioning factor throughout the preadaptive and the postadaptive phases. However, condition is not the same as cause: condition implies necessity only, it does not imply sufficiency. The *immediate* utility to the species as the limiting factor in the operation of natural selection (J. S. Huxley, 1954)[38] is evidently nothing more than another wording of causal relationship between the environment and the organism, and the irreciprocity of this relationship.

The breakdown of the classical picture came with chromosomal evolution. It means exactly what classical behaviourism rejects: a multiplicity of perceptual (and behavioural) organizations for each very special need. The input of sense data into an organic system, instrumental, as it is, in phylogenetic adaptation and in adaptive modification of behaviour, is much more than a straightforward acquisition and stock-piling of new information material, that is, learning in a general sense. It is neither an additive building up of "mental images" nor, in the phylogenetic case, of favourable gene complexes. Decomposition into the most elementary perceptual patterns is inherent in the process of "input," and it is implied in the non-congruence principle between the gene and every aspect of behaviour, as advocated by John L. Fuller and William R. Thompson (1967).

In more detail, non-congruence as residing in the evolution of genetic systems means that the neo-Darwinistic optimization principle implying survival only of those phenotypes of *immediate utility* to the species has to be generalized to include neutral "mutations" affecting genetically inert segments of the genome of varying extent the loss or duplication of which has little or no phenotypic expression. It is, however, capable of being transmitted to progeny with the effect of genetic isolation and splitting of ancestral groups without geographic isolation, that is, of originating new species not concordant with environmental challenge. Moreover, neutral or duplicated loci allow of heterozygous advantage being perpetuated in the case of

[38] C. D. Darlington, *The Evolution of Genetic Systems*, Cambridge, 1958, p. 239.

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homozygous inviability (or impaired viability) through incorporation into the genome of two alleles as two separate gene loci (Ohno). With this, natural selection turns from a composer and mediator of favourable gene complexes into a stabilizer of genetic systems with the effect of consolidation of well-tried gene constellations on the one hand and evolutionary "initiative and foresight" residing in the genome, on the other.

It is the intransigence of rigorous selective theory with its classical model of irreciprocity at the base of evolutionary as well as behavioural genetics that results in the entanglement of this theory between the strange idea of a gene chaos, a contradiction in terms, on the one hand, and niche specificity, on the other, that is, between an illusion and a dead end, or, in Simpson's words, "an odd and intricate mixture of the oriented and the random." There is no escape from this self-imposed constraint except into a meaningless Simpsonian Universe somehow akin to the Orwellian Utopia. Monod says of T. D. Lysenko that he was right in blaming the Mendelists for Kantian heresy; but Lysenko was right only insofar as, according to Weismann-Mendel theory, invariance is an inherent property of the gene. To the Lysenkoists, even the gene's invariance is a product of environment.

A gene stays invariant only as long as it is left alone; it may be exchanged by another one or an inert one. Especially, as Darlington remarks, each changed gene induces others to change in concert. Furthermore, after a gene has changed, it is exposed to selective pressure not invariably and not immediately. Evolution at the molecular level follows its own regular, but non-adaptive pattern, the very consequence of chemical structuration which allows of stabilization only as the effect of an agency outside its own mechanistic reach, that is, natural selection. To call this "mechanistic" or "idealist" is indeed, as Monod points out, a matter of terminology.

The true fallacy of every idealist philosophy resides in that it leads either to the doctrine positing the absoluteness of the mind (and, hence, of "prestabilized harmony") or to an insoluble epistemological contraction: the consistency of a theory of rigid mechanistic causation remains, within the confines of this theory, an insoluble problem. And herein lies the ultimate reason for the antinomic character of the objectivity postulate—"pure, and impossible to demonstrate" (Monod).

When applied to man, the concept of necessity is likely to suggest a messianic element of eschatology related to the problem arising from "the last things to happen." It is here, where speculative minds become inclined to view mankind under the auspices of the human species' ultimate destination, be it natural or supernatural. The Fathers of the Church have coined, long ago, the term "sub specie aeternitatis." Scientists of world-wide

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repute, like Julian Huxley and Teilhard, have indulged in such kind of "tour de force" leading to speculations, gloomy or radiant, as the case may be. Monod, too, starting from a "series of unrelated actions which become his (Sisyphus-man's) fate" eventually throws open the gates of the Kingdom of the Spirit "present within us." With this, the Manichaean division of the world is complete. Necessity may well be of two kinds as the fine distinction by the ancient Hellenes between *ananke* and *moira* suggests. On the one hand, there is the ironclad necessity of the orthodox Darwinians and Marxist ideologists as invoked by Friedrich Engels, the co-author of the Communist Manifesto, in his *Dialectics of Nature*. On the other hand, there is a necessity related to what is commonly called Destiny which may be taken as a synonym for the hereditary continuum. No man will like the idea of being a slave, either of his genes, or of his environment, or a slave of a transcendental Deity reigning with terror. For Western man, in particular, worshipping and being a slave are very different things. His attitude, though recognizing Destiny as a power to which even the Gods are subject—as evidenced in the classic Greek tragedy—nevertheless requires standing up in the face of a merciless Fate. "This above all: to thine own self be true." (Hamlet I, 3).

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The Anthropology of the Aunjetitz Population of Tomice, Poland*

By BRUNON MISZKIEWICZ

INTRODUCTION

In the spring of 1965 a farmer in the course of plowing came across countless broken pieces of pottery and numerous bones in the vicinity of the village of Tomice in the Dzierzoniow region of Poland. This is about 40 miles south of the Polish city of Wroclaw (formerly Breslau). The farmer immediately reported his find to the Conservator of Archaeology and to the Anthropological Institute in Wroclaw.

After thorough investigation of the pottery, systematic excavations of the site were conducted in the summer months of the years 1966, 1967 and 1968 under the direction of the author of this article. We came upon extensive Neolithic settlements, inhumation—and cremation—graves of the Early Bronze Age (Aunjetitz Culture), cremation-graves of the Lausitz Culture, as well as Early Medieval skeletal material (probably dating from the ninth to eleventh centuries A.D.) at the Tomice site. In this article only the Aunjetitz skeletal material is considered and an anthropological analysis is undertaken.

The material find comprised 37 inhumation and three cremation burials of both sexes and various ages—adults and children (see Tables 1 and 2). Without doubt we are working here with a continuous Aunjetitz burial enclosure. Furthermore, it is one of the largest which has been discovered in the Lower Silesian region in the past 25 years.

The grave enclosures themselves consisted of wide, almost square, burial pits, into which the dead were interred in an extreme flexed position lying on the right side. The bodies are orientated in south-north direction, with the cranium to the south and the face to the east (Figures 1 and 2). The depth of the graves varied from 0.25 to 1.20 metres.

All the body skeletons were relatively well preserved. The crania, in contrast, were in a somewhat poorer state of preservation. This is probably the result of damage in the course of deep plowing. The state of preservation of bones depends essentially upon the existing soil structure and upon the minerals found in the soil. In Tomice the soil consists predominantly of

*"Die Aunjetitzer Bevölkerung aus Tomice, Kr. Dzierzoniow", *Homo*, Vol. XXIII, No. 1-2, 1972, pp. 145-154. Translated from the German by Donald A. Swan.

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TABLE 1

State of preservation of the skeletal material from the Early Bronze Age site (Aunjetitz Culture) of Tomice, Poland—distributed according to sex and age

Skeleton number	*Grave number*	*State of preservation*		*Sex*	*Age*
		Cranium	*Skeleton*		
1	70a	Fragmentary	Fragmentary	?	Inf. I (a few days)
2	55	Fragmentary	A few remains	?	Inf. I (6-8 months)
3	62	Very poor	Poor	?	Inf. I (1 year)
4	II	A few remains	A few remains	?	Inf. I (1 year)
5	III	A few remains	A few remains	?	Inf. I (1 year)
6	"B"	A few remains	A few remains	?	Inf. I (3 years)
7	46	Good (complete)	Poor	?	Inf. I (3-4 years)
8	"A"	A few remains	A few remains	?	Inf. I (3-5 years)
9	4	Medium	Medium	F (?)	Inf. I (3-4 years)
10	66	Good (complete)	Fragmentary	?	Inf. (6-7 years)
11	31	Fragmentary	Fragmentary	F	Inf. II (10 years)
12	9	Good (complete)	Poor	F	Inf. II (8-10 years)
13	7	Good (complete)	Good (complete)	F	Juv. (15-17 years)
14	3	Very poor	Good (complete)	F	Juv. (17-20 years)
15	45	Very poor	Poor	F	Juv. (17-20 years)
16	75	Good (complete)	Good (complete)	F	Juv. (20 years)
17	17	Fragmentary	Good (complete)	F	Juv. (20 years)
18	70	Medium	Medium	F	Adult (22-25 years)
19	40	Fragmentary	Fragmentary	F	Adult (23-25 years)
20	61	Good (complete)	Good (complete)	F	Adult (22-25 years)
21	1	Fragmentary	Poor	F	Adult (25 years)
22	69	No remains	Medium	F	Adult (25 years)
23	I	Fragmentary	Fragmentary	F	Adult (25 years)
24	"C"	No remains	Fragmentary	F	Adult (25-28 years)
25	52	Fragmentary	Fragmentary	F	Mature (40 years)
26	53	Good (complete)	Good (complete)	M	Juv. (17-18 years)
27	68	Medium	Medium	M	Adult (25-28 years)
28	2	Fragmentary	Good (complete)	M	Adult (25-30 years)
29	34	Good (complete)	Good (complete)	M	Adult (28-30 years)
30	10	Very poor	Good (complete)	M	Adult (30 years)
31	18	Fragmentary	Good (complete)	M	Adult (30-32 years)
32	24	Fragmentary	Medium	M	Adult (30-32 years)
33	27	Fragmentary	Fragmentary	M	Adult (30-32 years)
34	29	Fragmentary	Fragmentary	M	Adult (30-33 years)
35	6	Good (complete)	Good (complete)	M	Adult (30-36 years)
36	76	Very poor	Weak	M	Adult (30-36 years)
37	11	Fragmentary	Fragmentary	M	Mature (35-40 years)
38	32	Very poor	Medium	M	Mature (40-45 years)
39	30a	No remains	Fragmentary	M	Mature (30-35 years)
40	"D"	A few remains	A few remains	?	Adult (?)

TABLE 2

Age distribution of the Early Bronze Age population from Tomice

Sex	*Inf. I*	*Inf. II*	*Juvenile*	*Adult*	*Mature*
Male	—	—	1	10	3
Female	1	2	5	7	1
Undetermined	9	—	—	1	—
Total (N = 40)	Inf. I + Inf. II + Juv. (N = 18) 45 per cent			Adult + Mature (N = 22) 55 per cent	

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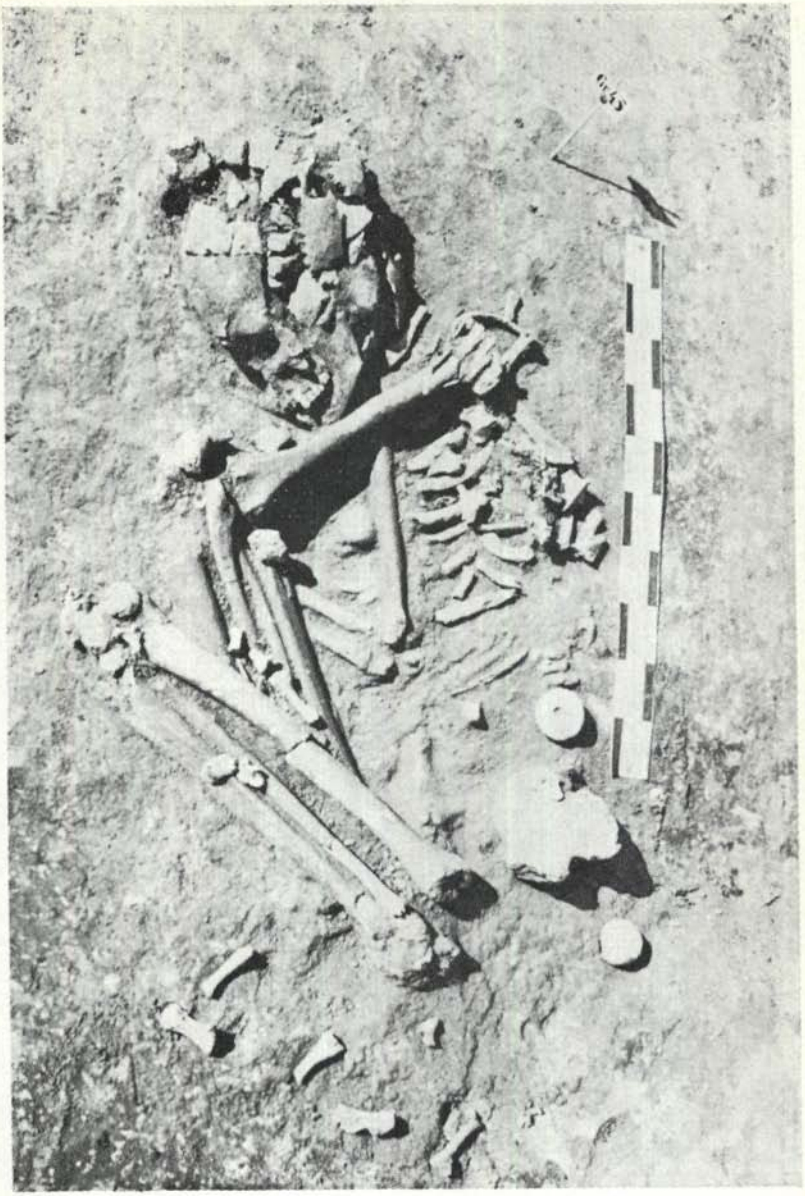

Figure 1—Juvenile female skeleton (about 17 to 20 years old) of the Aunjetitz population from Tomice (Grave 45).

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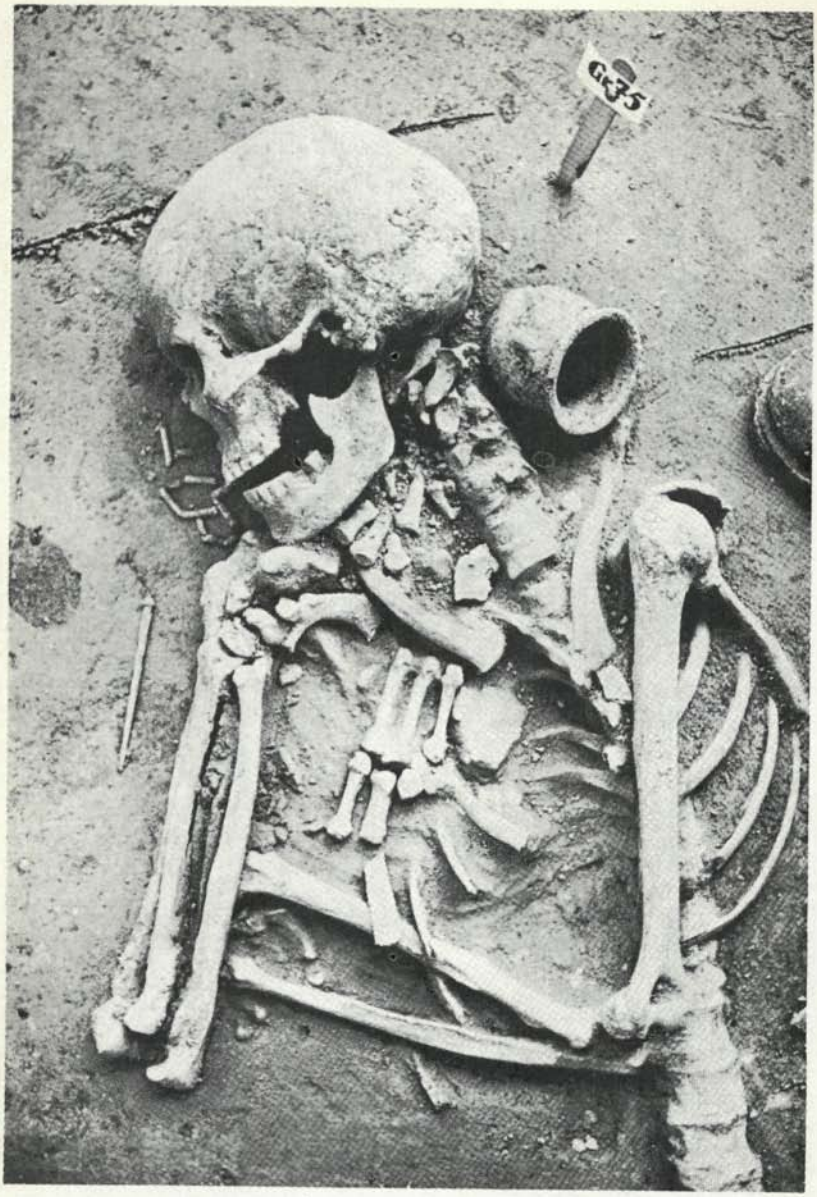

Figure 2—Juvenile female skeleton (about 20 years old) of the Aunjetitz population from Tomice (Grave 75).

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firm, airy and permeable *loess*. Consequently, the bones are all strongly mineralized.

The graves were richly furnished throughout with grave-goods and other items. These included ceramic pottery (some 70 dishes and beakers), animal bones, bone tools (awls, needles), as well as long bronze needles with compressed and perforated stems, spiral ornaments, beads, rings and arm-rings (altogether some 60 ornament-objects). It is noteworthy that the metal grave-goods were found exclusively in the graves of the women and children (in addition to the usual inventory of ceramic pottery and animal bones).

Among the 40 excavated graves, three are found to be double-burials. One of these was the grave of an older man buried together with a younger woman. The other two were burials of a young woman with a small child (infant). On the basis of this mode of interment, it appears that mother and child stood in high esteem in the Aunjetitz group.

All grave-goods are typical for the Aunjetitz Culture. These goods appear familiarly in Bohemia, Moravia, Lower Austria, Silesia, and Central Germany. They are partly derived from the Tószeg (Nagyrév) Culture. However, they are partly the perfection of their own cultural capabilities, with the exploitation of the ore deposits in their region. On the other hand, a Western influence is also evident. Hence, the Aunjetitz Culture stands between the Balkan and the Western Cultures of the beginning Bronze Age.

MATERIAL AND METHODOLOGY

The skeletal material was analyzed and morphologically described according to the standard measuring techniques of Rudolph Martin. This included both the crania and the long bones. For the typological analysis, Wanke's (1955) approximation procedure, with the anthropological constants calculated by Kóčka, was employed in addition to the morphological method. In this case the five principal anthropological elements, with their total combinations, which are generally known and defined in the Central European region are brought into consideration—Nordic (a), Mediterranean (e), Armenoid (h), Lapponoid (l), and Palaeo-Europid (p).

Table 2 provides information about the age distribution of the Tomice skeletal material. The age classifications—Infantile I, Infantile II, and Juvenile—were determined according to the scale of J. Gagnon and M. Bahador. The average age (mean value) in the case of the Aunjetitz population from Tomice amounts to 26 years for the two sexes taken together. For the men the average age is 31 years, while for the women it is 20 years. In comparison to other populations of the early Bronze Age, the average age of the Tomice Aunjetitz population is somewhat higher. However,

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this may be a result of the relatively small number of individuals in the sample. In addition, the age data of different authors are not always comparable, with some investigators excluding the children, for example.

In our Tomice Aunjetitz population, the Infantile II and the Juvenile groups are weakly represented, while the very old are completely lacking. The death rate of the former amounted to some 45 per cent of the total population (due to more difficult environmental conditions, hygienic deficiency and so on), while that of the adults was 55 per cent. Thus, the adult group is most strongly represented in the Polish Aunjetitz population. It seems doubtful whether we are dealing with a representative population sample in our tabulation. The data should make possible, however, an approximate survey, especially in comparison with the more recent data from Vallois (1960) concerning death rates in prehistoric populations (see Table 3).

TABLE 3

Percentage distribution of age at death in eight prehistoric populations

Prehistoric population	*Inf. I & II*	*Juvenile*	*Adult & Mature*
1. Neanderthals (N = 39)	38.5	10.3	51.2
2. Upper Palaeolithic (N = 76)	38.2	16.0	45.8
3. Mesolithic (N = 71)	29.5	8.5	62.0
4. Silesian Neolithic (N = 84)	29.7	5.7	64.6
5. Silesian Aunjetitz Culture (N = 40)	30.0	15.0	55.0
6. Halimba-Czeres: 9-12th century A.D. (N = 932)	33.1	8.5	58.4
7. Reckahn: 12-14th century A.D. (N = 270)	28.2	18.9	52.9
8. Opole: 13-14th century A.D. (N = 45)	33.3	6.7	60.0

STATURE

The stature of the Tomice Aunjetitz population was calculated from the long bones. For the men the method of Breitinger (1937) was employed, while for the women that of Bach (1965) was used. The male sample comprised seven, the female eight. In part the stature could also be calculated from the cross-section of the condyle radius according to the formula of Müller (1958-59). The formula was employed with seven male and six female skeletal remains.

The average stature of the Aunjetitz population from Tomice, Poland, is medium-large. In the case of the men it amounts to 163.0 cm. (N = 9), while for the women it is 157.7 cm. (N = 9). From a morphological viewpoint, the bone structure of the women is more gracile. In contrast, that of the men is more powerful. This difference may possibly be the result of an organized division

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of labor by sex, with the male population performing the heavier physical labor. On the other hand, aside from genetic factors, stature depends upon the actual racial structure of the individuals.

The calculated statures of the Tomice Aunjetitz population—especially that of the men—differ from the estimates made for stature of the Aunjetitz population of Czechoslovakia. The medium height of the men from Tomice is most similar to that of the men from the Late Phase of the Czechoslovakian Aunjetitz Culture. In comparison, the mean stature of the Tomice women is virtually identical with that of the Early Phase of the Czechoslovakian Aunjetitz Culture. It can generally be established that the male series for stature differ among themselves more sharply than the female series.

TABLE 4

Comparison of the mean stature of the Aunjetitz population from Tomice to that of the Aunjetitz population from Czechoslovakia

Aunjetitz group	*Mean male stature*		*Mean female stature*	
	No.	*(in cm.)*	*No.*	*(in cm.)*
1. Aunjetitz Culture—Tomice, Poland	9	163.0	9	157.7
2. Early Aunjetitz Culture—Czechoslovakia	12	172.3	5	157.0
3. Classic Aunjetitz Culture—Czechoslovakia	14	169.3	6	163.2
4. Late Aunjetitz Culture—Czechoslovakia	7	166.3	1	162.0
5. Total Aunjetitz Culture—Czechoslovakia	33	169.9	12	159.8

TYPOLOGICAL CHARACTERISTICS OF THE POLISH AUNJETITZ POPULATION

Ten crania—five male and five female—were suitable for typological (racial) analysis. In some cases the individual measurements on the skull were taken *in situ,* in order to prevent the loss of worthwhile material through eventual further damage. The calculated indices and the typological classification, according to Wanke's approximation procedure, are presented in Table 5 and Table 6. The mean values of the anthropological indices for the two sexes combined are listed in Table 7. In the case of the female indices, a correction was undertaken in order to adjust for the sexual dimorphism.

The male as well as the female Aunjetitz crania are characterized as follows: they are long, medium-high, with a narrow face, a medium-wide nose, and medium-high orbits. This trait-complex, together with the morphological traits, indicates a north-western combination—i.e., Nordic-Mediterranean (ea)—for the Polish Aunjetitz population. The results of the typological analysis are presented in Table 8.

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TABLE 5

Anthropological indices of the Aunjetitz skeletal material from Tomice

Skeleton Number	*Length-breadth index*	*Upper facial index*	*Nasal index*	*Orbital index*	*Height index*
13	60.0	54.5	53.5	85.0	—
15	74.0	—	42.6	82.4	—
16	63.2	56.0	41.7	81.1	85.8
20	73.1	59.7	48.0	81.1	84.7
18	63.0	49.2	44.2	—	—
27	69.8	—	—	76.7	—
26	77.2	—	50.0	76.3	—
39	71.0	57.5	44.2	76.2	74.9
20	65.7	50.0	47.9	77.5	—
35	69.5	61.7	47.1	86.5	78.0

TABLE 6

Individual typological analysis of the Aunjetitz skeletal material from Tomice

Skeleton number	*Nordic % a*	*Mediterranean % e*	*Armenoid % h*	*Lapponoid % l*	*Palaeo-Europid % p*	*Race type*
13	49.7	28.1	6.4	7.7	8.2	ae
15	65.4	26.3	4.2	2.4	1.7	ae
16	0.4	98.8	0.2	0.1	0.2	e
20	4.1	90.0	2.2	1.9	1.8	e
18	30.3	58.7	3.1	3.0	5.0	ea
27	1.3	94.0	0.3	0.5	4.5	e
26	13.4	22.7	10.3	32.8	20.8	lep
39	31.0	43.3	9.4	9.0	7.3	ea
20	13.7	67.4	3.4	4.6	10.8	eap
35	73.4	15.7	4.5	3.7	2.7	ae

TABLE 7

Arithmetic mean values of the anthropological indices of the Aunjetitz skeletal material from Tomice

Anthropological index	*Number of crania*	*Males and females*
1. Length-breadth index	10	68.7
2. Upper facial index (Kollmann)	7	55.9
3. Nasal index	9	46.7
4. Orbital index	9	80.3
5. Height index (Hrdlicka-Kocka)	4	80.9

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TABLE 8

Typological composition of the total Aunjetitz population from Tomice

Anthropological elements	*Anthropological structure—males and females*	
	From the Mean Values	*From Individual Analysis*
1. Nordic (a)	22.4%	28.3%
2. Mediterranean (e)	66.0%	54.0%
3. Armenoid (h)	3.7%	4.4%
4. Lapponoid (l)	3.6%	6.7%
5. Palaeo-Europid (p)	4.2%	6.4%
Total	99.9%	99.8%

In the total anthropological composition of the Polish Aunjetitz population, the Mediterranean racial element (e) strongly predominates, while the Nordic racial element (a) stands in second place. The three last racial elements—Armenoid (h), Lapponoid (l), and Palaeo-Europid (p)—play no essential rôle in the composition of the Aunjetitz population. The three elements together total on the average about 15 per cent.

For comparative purposes the mean values of five anthropological indices for Aunjetitz crania from Poland, Czechoslovakia (divided into three time periods), and Germany are presented in Table 9. From this grouping it can be seen that the Aunjetitz population from Tomice has a somewhat narrower face and higher orbits than the other Aunjetitz populations. The greatest difference, however, occurs in cranial height, which on average is some six units smaller than that of the Aunjetitz populations from Czechoslovakia.

Consequently, there are distinct differences in the racial structure of the various Aunjetitz populations. The anthropological composition of the three stages of the Aunjetitz Cultures from Czechoslovakia, as calculated by Chochol (1964), is presented in Table 10.

According to Chochol's data, the Nordic and Lapponoid anthropological elements are completely missing from the Czechoslovakian Aunjetitz populations. However, Chochol used a morphological analysis, which differed methodologically from our procedure. We also employed Wanke's approximation procedure to Chochol's data. By our method we obtained an essential Lapponoid component (about 15 per cent) and, to a lesser degree, Nordic admixture (about 8 per cent). Stocký (1931) had earlier maintained that in all Aunjetitz cultural stages the Mediterranean element amounts to about 80 per cent. However, this appears improbable.

The Aunjetitz population from Tomice deviates considerably in its anthropological structure from the comparable Aunjetitz

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TABLE 9

Arithmetic mean values of five anthropological indices for Aunjetitz cranial series from Czechoslovakia, Germany and Poland

Anthropological indices	*Early Aunjetitz (Czechoslovakia)*		*Classic Aunjetitz (Czechoslovakia)*		*Late Aunjetitz (Czechoslovakia)*		*Total Aunjetitz (Czechoslovakia)*		*Aunjetitz (Germany)*	*Aunjetitz (Poland)*
	Male N=12	Female N=5	Male N=14	Female N=6	Male N=7	Female N=1	Male N=33	Female N=12		N=10
1. Length-breadth index	70.1	74.5	72.8	72.4	69.2	79.4	71.0	74.0	69.6	68.7
2. Upper facial index (Kollmann)	52.0	54.2	53.1	49.2	54.2	55.2	53.0	52.5	54.8	55.9
3. Nasal index	49.3	52.6	48.0	60.4	50.0	49.0	48.9	55.4	47.8	46.7
4. Orbital index	74.8	78.5	77.8	74.3	82.1	79.5	77.7	77.1	78.2	80.3
5. Height index (Hrdlicka-Kocka)	—	—	—	—	—	—	87.3	87.8	—	80.9

TABLE 10

Anthropological composition of the Aunjetitz skeletal material from Czechoslovakia (Chochol, 1964)

Anthropological elements	*Early Aunjetitz*	*Classic Aunjetitz*	*Late Aunjetitz*
1. Mediterranean (e)	50.0%	55.0%	55.0%
2. Palaeo-Europid (p)	35.0%	25.0%	35.0%
3. Armenoid (h)	15.0%	20.0%	10.0%
Total	100.0%	100.0%	100.0%

series from Czechoslovakia. It can be assumed that population groups from Czechoslovakia moved into the Lower Silesian region in the late stage of the Aunjetitz Culture. They brought with them chiefly Mediterranean and Palaeo-Europid traits. In the Lower Silesian region the migrants met with the autochthonous population. These people were probably the descendants of the Bell-Beaker Culture and the Cordedceramic Culture, and also the Bandceramic Culture. From the last cultural group the Lapponoid element on a Ugro-Finnish base is derived. It should be noted that the population of Central Europe during the Bell-Beaker Culture and the Bronze Age still showed a typically Alpine structure. Therefore, it seems as if the population from Czechoslovakia still bore the archaic Aunjetitz form-structure.

In so far as observations about the anthropological structure in the Lower Silesian region are representative, one can see in this structure a certain starting-form *(Ausgangsform)* which leads to the typical later West Slavs. Thus, we find a resemblance between the Bronze Age Aunjetitz population from Tomice and the Early Medieval population from Tomice. However, to clarify further this question, additional excavation and studies are required.

SUMMARY

The skeletal remains from 37 graves, including three double-burials, in Tomice, belonging to the Bronze Age Aunjetitz Culture were anthropologically investigated. Of the 40 burials 18, or 45 per cent, were of children or juveniles. The mean stature of nine males was calculated to be 163 cm. and that of nine females to be 157.7 cm. (Breitinger/Bach method). These values are below the average for Aunjetitz populations. The typological analysis (Wanke's method) shows a preponderance of Nordic and Mediterranean racial elements.

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In Praise of Poetry

(With respects to Sir Philip Sidney and Shelley)

By DESMOND TARRANT

> It is the worshippers of beauty, after all, who
> have done the real pioneer work of the world.
>
> Henry David Thoreau (1817-1862).

Only recently has man's frame of reference become large enough to assess the last enemy other than subjectively. The aim of this brief essay is to try to place age-old subjective insights within the new objective, empirical frame of reference. The spiritual findings of such as Sidney and Shelley—which reflect a primordial cumulative heritage—receive abundant confirmation. But now they can be expressed as hypotheses with tangible evidence for verification. This process should make them eventually as irrefutable as the boiling temperature of water. As scientific hypotheses can be verified by repeated experiments, so the spiritual hypotheses may be verified by repeated experience.

Astronomers, such as Fred Hoyle, tell us that in the beginning there was nothing but very thinly spread atoms and simple molecules comprising largely hydrogen. Out of this was to come everything else—including men and machines. This thin gas seems to be the nearest we can approach the Creator physically. But, of course, it is everywhere. Its composition is now considered to be mostly hydrogen, helium, some carbon, nitrogen, oxygen and a few metals. These are the raw materials on the many benches which are the galaxies of the workshop of the universe itself.

However, for about every cubic mile of this gas exist about one thousand particles of cosmic dust. This dust is not spread evenly but concentrated here and there in clouds. Each cloud has enough material to produce about 400 stars like the sun. This original matter has become the matter with us. Etymological significances of the word matter or material are Latin *mater* and Greek *meter* meaning mother. So with this matter we have the body of the universe. Einstein's theory of relativity seems to confirm that the universe is indeed one verse; the meter is inherent in the motion. Here is the body from which all offspring must come.

The offspring must come because this body is in motion and has intercourse with a charge. This charge or magnetic field is vital. It aligns the dust particles, thus giving direction. Its origin is still unknown. Here we again seem to be as physically near the Creator as we can come. This union of magnetism, motion, and matter involving needle-like dust particles anticipates the

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fertilisation of eggs by spermatozoa—a process still dependent on personal magnetism. As the matter is the body of the mother, the charge seems to embody the injected psychic energy or libido of the father.

In other words, in the workshop of the universe, along with the raw materials, there is also a controlling and directing force. Where the matter is passive, the charge is active. Together in motion they give birth to galaxies of stars and planets. All remain inter-related.

The core of the earth is largely iron; its motion converts it into a giant dynamo making a magnetic field; this interacts with high-speed particles streaming from the sun and oscillating between the earth's poles. Sun, moon, earth and stars all remain intimate. Their relationships produced a series of effects first chemical, then biological. As these effects constitute consistent and undirectional growth, they could be fully and precisely calculated. In fact, they seem to be the rudiments of external necessity. This was to be regarded later as the gods, fate, or that Divinity which shapes our ends. Now it is seen as *immanence* producing evolution, possibly given a specific direction by orthogenesis in a process of calculated creation.

As we ourselves are sexually differentiated only on the biological bisexual foundation of chromosomes, as illustrated in the early embryo in the womb, as Eve was made from Adam, as the neutron is neither positive nor negative in charge, so this matter, motion, and force could derive from a bisexual Creator. Thus the symbolism of Hermes and Aphrodite would be objectively verified. Yet when male and female of necessity get together, osculation for cleansing eventually becomes an act of love. What the Creator ultimately derives from the matter may be the matter of most concern to us, His creations.

However strong the scientist may be on cortical functions, he may still be dangerously weak when it comes to diencephalic or emotional functions. No one can compare with him, perhaps, among the denotations; but sometimes he is not so happy among the connotations. He is fine on the edge of the wood but not so good in the middle. Thus, Fred Hoyle, having stripped the bark so magnificently, states that "we still have not the smallest clue to our own fate.[1]"

There are many clues. The sap of the matter may be approached closer through a law promulgated by the scientific philosopher Herbert Spencer in *First Principles* (1862). All manifestations are of the one cosmos, whether chemical, biological, historical, or individual. Spencer seems to have formulated a theory which renders these manifestations consistently intelligible as parts of a whole. The law expresses the

[1] Concluding line to *The Nature of the Universe*, Oxford, 1960.

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continuous redistribution of matter and motion as derived from persistent force in alternating processes of concentration and diffusion. It states that the concentration of matter implies the dissipation of motion, while the absorption of motion implies the diffusion of matter. This could be called the Law of the Pendulum. It makes all the difference in the world. Spencer claims that this law governs the entire cycles of change of every existence and applies to every detail of change. It is as if the largest pendulum of continuous creation contains ever smaller ones, down through the solar system, ice ages, and political change to the phases of an indivudual's life and the ultimately infinitesimal process of metabolism in a total process of metamorphosis. The etymological significance of the word psyché is "butterfly."

Spencer's law both predicted and is corroborated by Professor Martin Ryle's recent discovery of the diminishing numerical density of radio stars.[2] If we turn from the infinite to the infinitesimal, what do we find? According to a medical psychologist in an article "The Chemistry of Mind."[3]

> Temperament is mainly controlled in the mid-brain by what must be a balancing action between stimulation . . . and relaxation. . . . The balancing mechanism must be capable of regulating and timing itself so that it produces energy in a rhythmical manner and gives rise to the right activity of the appropriate degree in the right place at the proper time.

In addition, Dr Fleiss, a German physiologist and psychologist, has recently ascertained three overlapping cycles of biological rhythm in human beings. One is of physical endurance over 23 days; one is of nerves, or emotional and creative, of 28 days; one is of intellect, involving memory and alertness, of 33 days. These cycles correlate with dates of birth (note the evolved transformation of superstitious astrology into the magic of science) and are to be computed to predict pilots' off-days. Here seems to be further most substantial confirmation for Spencer's Law of the Pendulum. As Hamlet said to Ophelia, we are machines—but the important fact is that we are vehicles of evolving spirit or soul, the etymological meaning of which, through Old English and Greek, is "light, colour and mobility." After all, according to the quantum theory, particles seem most intelligible as waves. Thus, the whole universe could be a manifestation of "Soul."

The opposite processes of disintegration and integration are simultaneous but give a balance to one or the other so that each will dominate alternatively. Spencer identifies important

[2] See Ernst J. Opik, *The Oscillating Universe*, New York, 1961.

[3] *The Listener*, London, 16th February 1961.

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secondary effects. As the pendulum swings upwards to rest or peace and harmony, the matter absorbing motion has become more complex and its parts further differentiated and individualised whether this matter is Hamlet out of turn and harsh, or a multiplying universe. When the pendulum swings down again and matter again goes into motion, that motion itself becomes more functionally complex, particularly in war. Again this seems objective verification for the Rule of Heraclitus that everything must produce its opposite.

Thus, disintegration is merely the means to further growth at ever more complex or higher levels.

Spencer's law, which seems to be the vital clue to a process which started from dust and produced man, does not appear to be outdated. The fundamental particles still accord adequately with the laws of the conservation of mass-energy, charge and spin as do the giant, spinning, spiral galaxies. Problems such as matter and anti-matter, and the apparent non-conservation of parity in the decay of "strange" particles seem resolved with further knowledge. In fact, as the charge known as strangeness seems the only one not giving rise to force, it could be another vital clue to the growth of psychic energy or spiritual reserves; it could be what the Creator gets out of his work—the distinction between life and death, a kind of spiritual residium of evolved psychic energy.

In the light of quantum physics, Spencer's fundamental propositions may not now be fundamental enough. Even Bertrand Russell is prepared to gamble on the persistence of matter if not on the law of gravity—so Spencer's "Indestructibility of Matter" may hold good, bearing in mind that matter is only patterned energy. However, his "The Continuity of Motion" may not be quite right if energy at its smallest, in quantums or photons, is discrete when looked at bit-by-bit. Yet the *effect* is of continuous motion. Similarly, perhaps his "The Persistence of Force" should be replaced by "The Distribution of Energy," a distribution leading to very forceful effects.

If quantum physics appear rooted in chaos or chance, they soon seem to yield to law and order aiming at stability. It is rather as if a heap of indeterminate iron filings were being subjected to a strong magnet turning their chaos into order. It is unfortunate that Hitler and Mussolini still have so much magnetism leading eventually to apparent chaos again. By the time we get to biology, the organism seems very ingenious in dodging any random effects. Professor C. R. Frisch, in a talk on Causality on the B.B.C. ("A Few Ideas," 1964) said:

> Indeed, the more we study living organisms, the more we admire the cunning with which they exploit those features of

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quantum physics which make for stability, and avoid the consequences of those uncertainties that go with it.

The looseness which is inherent in quantum physics may account for an occasional involuntary twitch; but my will is free—that is, free to act on all the information I have—only so far as my brain is subject to causality.

So Spencer's superstructure, his law of the pendulum seems to remain valid. As Einstein said, an unbelievably high Intelligence must be at work putting himself or itself into his or its creation as a novelist into his novel. The odds against chance arranging the proper chemicals into proteins are so high the earth just is not old enough to permit chance to do it. And then the proteins still have to be animated.

Spencer points out that nothing can be finally interpreted until placed within this evolutionary frame of reference. He also indicates that integration or God and dissolution or the Devil work to the same end; that all religion and philosophy is moving towards a further reduction of monotheism to be replaced by the concept of an immanent Creator expressing Himself from *within* his creations.

Thus, we could be simply embodiments of the Creator's imagination in which history is His story, matter being no more than patterned energy. We are ourselves a kind of colour television. We are being lived by something which needs billions like us to express itself.

Attributes of dissolution in the interests of increasing functional complexity are, at the highest level, analysis of fresh evidence and representational art; lower down will be a multiplication of effects as in Thorstein Veblen's ostentatious expenditure or conspicuous consumption; also will be loss of values as earlier syntheses disintegrate and promiscuity of judgment and conduct lead to intensifying violence.

Attributes of integration will be, on balance, the syntheses of romanticism instead of realism; liberal legislation of these syntheses; more general well-being in an era of peace. The two processes are simultaneous but give a balance to each alternatively. The swings are clearly discernible in the alternations of romanticism and realism, deductive subjective philosophy and inductive objective philosophy, and liberal or reactionary government—all parallel manifestations. The nineteenth century, the romantic age of ideology, disintegrated into the twentieth century, the age of analysis, violence, and promiscuity but also of greater objectivity and high standards of social welfare.

The scientist and the scientific philosopher supply valuable clues. These bring us to man himself and the philosopher-historian. Toynbee's *A Study of History* establishes the primary

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principles of motivation responsible for the rise and fall of civilisations. Life emerges as a challenge to which various responses are possible in a process of conflict. The conflict is necessary to put matter into motion, to provide the tension correlative to growth. The responses are conditioned partly by the environment. If the response is adequate, survival results.

Practical considerations must predominate initially. Here are the beginnings of conscious or directed thinking. But survival alone is not enough. It needs to be enjoyable. So man's inner desires operate to adapt the environment itself in the interest of pleasure. When the cave is safe, warm and possessed of food, the murals on the wall or television screen become the centre of attention. The practical considerations are conditioned by environment; the desires released by and for mastery of the environment come from within. The former develops the frontal lobe or conscious mind and cognitive ability; the latter flows up instinctively from the subconscious depths in rhythmic emotion.

We are only too aware of practical considerations—more or less synonymous with expediency and compromise. We have almost fogotten those ideals which mould the environment for enjoyable survival. As Toynbee illustrates, if man cannot go beyond practical considerations, his survival itself is relatively short-lived. A breakdown occurs and his civilisation passes away or becomes fossilised.

However much the tree is pruned, the sap cannot flow if the roots are starved. This requires man to remain in contact with his ideals. These are within his subconcious in images of conflict. They are embodied in healthy art and show what leads to evolution and what to dissolution as in Prometheus and Jupiter, Christ and Pilate, Hamlet and Claudius. Both sides are necessary—all problems of beauty and morality are resolved by this frame of reference as beauty still embodies truth but at last resolves the ambiguities of good and evil—good being what integrates, bad what disintegrates.

Toynbee's truly great achievement was to show that the environment was not, ultimately, the controlling factor but simply contributive, that the controlling factor is within man himself. He shows that the response is a judgment by but also upon man. Every day is Judgment Day. It is man's disadvantage that to survive he must be practical, yet nothing diffuses integrity like expediency.

On the other hand, the artist who integrates will grow in sincerity, and consequently become more physically vulnerable as, for example, when Tolstoy practised what he preached sincerely enough to be excommunicated. But without the artist man becomes arrested. To be arrested is to go to gaol. To be in gaol is to be in hell?

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Toynbee illustrates a fundamental rhythm or cycle of three-and-a-half beats in the general process of disintegration in societies which lose their ideals. Still we have one verse with a consistent meter illustrating Spencer's law. Still we have the same material, the same technique, and the outcomes of the same primary motives in man as at the start. As it was in the beginning. . . .

However, as the scientist could see *no* clue, as the scientific philosopher concentrated chiefly on external manifestations, so the historian, when he does at last objectively bring us to the psyché, misplaces the emphasis by elevating the conscious above the subconscious. For Toynbee concluded that man has a measure of freedom of choice during periods of growth. He considered[4] that to be free is to keep the subconscious under the control of the conscious will or reason; thus, and only thus, could man hope to control the law of Nature and be free from destruction. This was a natural error as the dominant psychology of the time was Freud's, which regarded the subconscious rather like a refuse bin for the unwanted.

Now, however, the findings show otherwise. For an understanding of the psyché or spirit itself we must turn to the psychologist not of disintegration but of growth, to Carl Jung and his followers. Anyway, as Tolstoy insisted in the second epilogue to *War and Peace,* matter is either under complete control or is, in fact, not controlled. Jung confirms Tolstoy's reasoning that we must give up a freedom that does not exist and recognise a control of which we are unconscious. As soon as we do this and can work harmoniously with this inner necessity we feel free, as Milton showed in *Samson Agonistes.*

But Toynbee has shown empirically that man makes one of four responses to the challenge of life. Two of these are negative and produce disintegration. They are symbolised by such as Jupiter, the Devil, Claudius, Nicodemus, or self-interest. Two are positive, produce integration, and are symbolised by Prometheus, God, Hamlet, Christ, or self-sacrifice. All of us have some of each of these. Both sides are necessary. The lowest and most childish response is the inability to recognise and correlate significant experience, with a consequent loss of orientation and passive acquiescence or drift as in Hamlet's mother. This is the response of the overwhelming majority of people at our present, very early stage of development. Its active but negative counterpart is when the conscious mind cannot distinguish among its subconscious instincts and gratifies the carnal ones in a process of abandon. Pindar and Tennyson's eagle of power is then the Nazi eagle. Marlowe's *Faustus* sums up the cause and the effect at this level.

The two positive responses also consist of one passive response

[4] Arnold Toynbee, *A Study of History* (abridged), Vol. II, pp. 287-288.

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and one active. Here the passive involves withdrawal to analyse and understand—as with Hamlet and his words. If understanding is fully achieved then the highest, most childlike stage of growth is reached and an active return is made to transform the society in the light of understanding for integration and growth. Concomitants of the negative responses are fear and a belief in chance or superstition; concomitants of the positive are an increasing sense of élan or freedom, and belief in the virtues of necessity in an increasingly conscious perception of the Creator's aims and methods in a process of disciplined responsibility. Each one of us is making one of these four responses; in accordance with the majority, so is our society for better or for worse.

Since the end of the last phase of growth in the nineteenth century, with its affirmative romanticism, the two businessmen, Faustus and that inductive thinker, Falstaff, have ruled triumphant. Arnold articulated the situation in *Dover Beach,* anticipating Dunkirk. Inevitable accompaniments have been violence, fear, objective philosophy, realistic or analytical art, and ever faster motion. All culminated in the damnation of financial, spiritual, social, and artistic bankruptcy, Western civilisation risking the same rejection as met Falstaff. All his poetry came from lust and rage, said Yeats, adding that night after night he could never get the answers right as he exploited the fragments of his own personality, representing and articulating the *Waste Land.* The remnants of two world wars further exalted promiscuous expediency.

The psychologist shows that the neurosis of disintegration, the sense of futility which makes the world flat, stale, and unprofitable, can be cured only by reconnection with the roots of being embodied in symbols below consciousness. These express themselves individually in dreams, collectively in art. Where Toynbee followed the mythological clue as far as man's conscious mind, Jung follows it into the thick, strangely populated, dark but sun-splashed forest of primordial continuity. Here are all man's personified emotional drives, a great surge of instinctual carnal energy, the tiger in the night, the horse that must be tamed, the serpent of discord, and the squawking ravens of darkness. Here also are Spencer's silver moon and Milton's sun-bright sword. Here are all those laws we cannot consciously accept, making us suffer until we *can* accept and obey. Monkeys are trained for space travel by giving them shocks until they make the correct response to signals and images.

To climb Toynbee's or Jacob's ladder of etherialisation is to remain in harmonious union with this primal force and to do its will constructively in fashioning the external world. Man comes from his conscious external self to his subconscious eternal self. This Self is the Creator. The union is still that of the male or

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conscious intellect with upwelling fantasies from what Jung[5] calls "the maternally creative side of the masculine spirit."

The union of directed thought with upwelling "female" emotion forms imagination. With this the poet analyses experience to identify its meaningful aspects and communicates his understanding in recreated forms for greater effect and durability. He does this for pleasure; in doing this he grows towards his inner self; in doing this he moulds the environment in accordance not with mortal self-interest but with a larger and more lasting self-interest. The poet is simply that form of life sufficiently evolved, strong and impersonal—Thoreau's "toughest son of Earth and Heaven"—to seek and find the signposts of the subconscious. However tumultuous his search he finds also, as Dylan Thomas said, a moment's peace in resolving the discord of his search by articulating, more or less profoundly, the forces in his conflict which bar him from his self. As the psychologist shows, all his cries still concern water, alarm, or mating as he tries to communicate to the family. The poet is the sap. But the sap is life.

The definitions of imagination of such as Wordsworth, Coleridge, and Shelley, were in effect confirmed objectively by Spencer when he said that the highest level of knowledge is when generalisations previously separate give a new meaning when juxtaposed. Now there is further objective verification from Medical Science as Sir Russell Brain notes in his essay "Words" in *Some Reflections on Genius* (1960) that recent enquiries suggest that the frontal lobe of the brain has a main task of integrating "the cortical function which we may broadly call 'knowledge' with the diencephalic function which we may broadly call 'feeling'." Poetic genius would appear to be the highest simply because it requires an even union of both these two functions in an advanced state of evolved complexity.

The highest quality both of general and specific factors of intelligence select, co-ordinate, and direct root desires which keep the horses of "id ego and super ego" harmoniously in harness. Only the great poet is at all really capable of this. Only he can articulate the universal forces echoed in his own journey to his self. Yet all are committed to the descent to Demogorgon, the climb to the summit of this spiritual Everest. Without the words of the poet and artist, there are no signposts; without direction there is futility; with futility is fear; with fear is guilt; with guilt is violence; with violence there is the opposite of growth. There is disintegration. But can there be death? What is there to destroy?

[5] Karl Jung, *Modern Man in Search of a Soul,* Routledge and Kegan Paul, London, 1933, p. 76. This has been taken much further by Erich Neumann. *The Origins and History of Consciousness,* Princeton and Routledge and Kegan Paul, 1954.

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The psyché is everywhere, one and the same, a means in whatever form for further growth when, with the next swing, the unacknowledged legislator is again heard by spirits in better shapes. It is at least a valid possibility.

As the psychologists shows, the subconscious provides us with an internal necessity. This works through the senses and eyes to unite with external necessity. Necessity is the mother of invention. By successive returns to the mother of her substitute for renewals, rebirths, or resurrection, the poet becomes more or less divine, even if led by the devil. Only the poet's divinations lead to a golden world, given direction to the inventions. Medical science has revealed, in operations with electrical probes deep into the brain, that the past is as if stored on a film. Many have accurate dreams of future happenings they live out in fact. It is as if all life is contained in the brain to be lived out as the stored inner images coincide with that external environment which elicits electrically the relevant images which trigger off responses for action. So we puppets dance. In proportion as the images become symbols—through preciser observation—a hidden pattern of cause and effect emerges which makes life increasingly intelligible — intuition may well be simply an efficient brain simultaneously juxtaposing the relevant past experience with the present to supply an instantaneous judgment.

If intellect makes words and words intellect, then it follows inevitably that any society evolving instead of declining must express a flourishing tradition of imaginative poetry. In other words it is always good when the ship of state has a major poet—as with Pindar, Vergil, Dante and Milton—checking the plumb line.

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Socio-economic Life of the Onge of Little Andaman

By B. K. CHATTERJEE and ARABINDA DATTA GUPTA

The Andaman group of islands are situated 250 miles from Madras and 900 miles from Calcutta. From north to south the Great and Little Andaman islands cover a distance of about 210 miles. Little Andaman, which lies to the south of Great Andaman, is 26 miles long and 16 miles wide. It is called *Engae* or *Onge* by the natives of Little Andaman. The exact numbers of Onge, Jarowas and Sentineles is difficult to discover but from our personal contact with the Onge we believe that in 1953 there were hardly more than 500.

Even the most elementary principles of agriculture are unknown to the Onge and they exist by hunting, fishing and collecting wild roots. The process of making fire and the arts of smelting iron are still unknown to them and what methods they do use are the result of recent contact with civilised people. They live in communal huts near the sea shore and in the interior of the forest. The quest for food has made them almost nomadic. Both males and females wear hardly any covering.

From careful investigation we discovered that, except for minor modifications, the habits of the Onge remain much the same as they were in remote prehistory, and in fact in the prelithic period. The culture of Great Andaman evolved to a greater extent due to the fact that it started in the north. Like the Semang and the Acta, the Onge do not practise tattooing or scarification.

The Onge do not have chiefs, only headmen who guide groups of families who roam about together. Nobody is ranked above these headmen.

As we have observed above the Onge never learned how to make fire and, having got it from outside sources, they have to keep it going all the time. Cooking is mostly of the boiling variety, but this dates only from the time the Onge received pottery from outside, long after their arrival in the Andamans. Evidently before that everything was cooked in ashes, or directly over the fire or on hot stones. Big animals were hacked into pieces and cooked on hot stones in a thick packing of leaves covered with earth. Harpoons, spears and harpoon-arrows were certainly used long before the Onge had any knowledge of iron.

A typical day in the life of the Onge starts with the preparation of a " pipe " of dried leaves pressed into a crab's claw. Males and females start smoking from early in the morning. The Onge

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paint their bodies with ochre on which they draw various geometrical figures. For breakfast they eat pieces of pork or turtle meat left over from the previous evening's meal. The Onge wives shave the heads of the male members with the help of sharpened stones and broken pieces of bottle. Relaxation in the form of mild gossip takes place for a short time and then they go out fishing or collecting roots from the jungle. On return they distribute their catch among other members of the family. With the help of hollow stems they suck fat from a vessel of boiling food and this continues for some time. Salt is completely unknown to the Onge. Frequently they sing and dance with female members in separate groups after taking their meal at night.

Girls get married very early. Marital relation laws appear to be very strict. The Onge always squat in pairs—the women in front of the man and almost in his lap. During one visit, the writers saw a lone female lying disconsolately apart from the others. Inquiries revealed that she had just been widowed. Obviously the widow has no place in the community.

Some ossuary practice is noticeable, as amongst all such primitive people. Preservation of the bones of the dead might give the psychological satisfaction of close proximity of a deceased one. It need not have any religious significance.

People having the fundamental concept of a Supreme Being cannot be said to have no religion. Whether the religious ideas of the Onge are crude or developed is something that could not be asserted. No evidence was available of religious practice.

A typical Onge communal hut is shaped like a beehive and has a very low opening for the entrance. The roof is thatched and supported by poles. It measures about 20 ft. long by 10 ft. wide and contains anywhere from eight to 16 small platforms raised between 18 inches to 3 ft. from the ground. These platforms were particularly in evidence in the communal huts inspected near the Dugong creek settlements. The platforms are only large enough for one person. Two similar platforms are used for household possessions. It was interesting to note the existence of two graves inside a hut and above them platforms intended as resting places for the spirits of the deceased.

The Onge bury their dead inside the hut in which the deceased lived or very close to it. When a person dies his body is kept inside the hut for a day and then members of the family assemble and lament over it. The body is then carried, generally by members of his family, and buried in a crouched position with the hands covering the eyes. After a few weeks the jaw is taken from the body and the widow or, in her absence, the eldest daughter, wears it for some time like a necklace round her neck with the jaw resting on her chest. A precious possession of the deceased is buried

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with him. The practice of painting the skeleton is common among the Onge.

In 1967 displaced persons from East Pakistan (Bangladesh) were settled among the Onge. Their job was to tap the wealth of the forest. With the help of the local administration a rest-hut was designed for the Onge in the middle of a small farm at Hut Bay where tapioca, bananas, coconut, papaya and vegetables have been grown. About nine years ago a 200-acre coconut plantation was raised at Dugong creek in the north-east corner of the island. The Onge, who have built their own hut there, have made good use of the coconut. Evidence of this can be seen in some beautifully woven fibres they have produced. The tassel of yellowish fibre used by the women as a brief covering is quite artistic.

The Onge build and use seaworthy canoes. They have learned to use the knife (*dah*), chisels and files and are keen to acquire these to replace their ancient implements.

The Onge are racially akin to other negrito tribes of the Andaman Islands but they have distinct social and cultural customs. *Enilalabe* is their word for dance and *gaga* is the word for song. The dance is of the usual "contralance" type with males and females standing opposite each other. During the dance both men and women are practically naked—the men wear only a narrow strip of cloth and the women a round broom-like tassel mentioned above. They decorate their bodies with two types of a variety of clay, one yellowish grey and the other a brownish red. Both men and women draw decorative designs on their faces. Females also decorate their waist, chest and back in this way.

The Onge have many different dances, each distinguished by a different name. Onge women dance at weddings and at death ceremonies. There is general dancing, too, when numbers of families assemble at a hut. For dancing both men and women generally wear head-dresses. Whenever they do well on their hunting expeditions for pig or honey and make good catches of fish, turtle and crab the Onge celebrate by dancing. Some dance forms are recognised as being more sacred than others. The Onge do not have musical instruments of any kind. Some dances are accompanied by the participants but beating of feet on the ground provides the necessary rhythm. Some dancers produce a rhythmic beat by striking their heels between their buttocks.

The Onge do not appear to celebrate the advent of puberty with special celebrations. Girls are allowed to move about and attend to all domestic duties. To indicate that they have reached puberty the girls cover their sexual organs with green leaves. They do not appear to know when they expect to attain the age of puberty.

The marriage ceremony of the Onge is very simple. The bride-

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groom simply takes the hand of the bride and takes her into the hut without protest. The whole system being highly endogamous no Onge dares to oppose the jurisdiction of his own group by having any outside matrimonial connection. An exchange of presents such as bows and arrows, pigs, honey, fresh-water fish or firewood, takes place between husband and wife. Normally marriage takes place when the girl attains puberty. Widow marriage is common. Polyandry is not practised.

There are no ceremonies to be observed during the state of pregnancy to the birth of the child. The birth is completed in a rather crude manner, the umbilical cord being separated by the mother-in-law or even the husband. Unless she is physically unfit the mother of the new-born child is allowed to go out to hunt for food or carry out domestic duties. The occasion is strongly influenced by popular superstition. For example, the mother of the husband presents some fish and crab to the wife's mother as a form of rejoicing.

A party of friendly Onge—usually six families—have camped in Hut Bay. Cultural contact with local labourers has been established through bartering. The Onge offer wild boar, meat, fish and honey in return for tea, tobacco and trinkets. Many think that smuggled opium is also involved.

It appears that the Onge intend to come out of their utter isolation. Some of the Onge have picked up Hindi and it is reported that five or six Onge children attended school at Hut Bay.

Investigation reveals that the sickle cell is found among the Onge. The sharp decline in their numbers can be seen from the table below. Biological incompatibility and disease has caused a sharp decline in their longlevity.

An analysis of the population of the Onge, Jarowas and Sentinelese taken from the Cenus of India provides the following figures:

	1901	1911	1921	1931	1951	1970
Onge	627	631	346	250	150	129
Jarowas	—	—	114	70	—	500
Sentinelese	—	—	117	50	—	50

Investigation shows that there are at present about 250 Onge. Since they are almost nomadic, wandering about hunting for food, it is not possible to obtain exact figures.

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Book Reviews

RACE QUOTAS IN U.S. UNIVERSITIES

By George C. Roche III. Open Court Publishing Company, La Salle, Illinois, 1974. Pp. 89. Price $1.95.

At a prodigious cost to American taxpayers, the "reverse racists" in the Nixon-Ford Administration are destroying the higher educational institutions of this country and reducing our academic standards to insipid mediocrity.

In this trenchant and important short volume, George C. Roche III describes how this program operates, the flimsy legal basis upon which it rests, and the injustice and havoc it has already inflicted on the American academic community. A former Marine officer and the author of several books on history and political science, Dr Roche is President of Hillsdale College, an institution which has preserved its freedom by refusing all U.S. Government aid.

The Affirmative Action bureaucracy, which enforces race and sex quotas on all universities and colleges receiving Federal grants, has so proliferated that the Health, Education and Welfare Contract Compliance force alone consists of 500 employees. The Equal Employment Opportunity Commission, which has jurisdiction over all American educational institutions, whether they receive Federal aid or not, projects a budgetary increase of $43 million at a time when the administration is allegedly combating inflation.

This H.E.W. bureaucratic complex today dominates the hiring, firing, promotion and entrance practices of the nation's institutions of higher education. It does so in the interests of securing proportional representation for so-called minorities. Their definition is obscure. "I envy the young and the young in heart," wrote Milton Himmelfarb, "who do not experience my occasional difficulties in grasping that while American women, who are more than 50 per cent, are a minority, American Jews, who are fewer than 3 per cent, are not a minority."

Since Federal civil rights legislation upholds equal opportunity and bans racial discrimination, H.E.W.'s Office of Civil Rights has had to move with Machiavellian indirection to disguise race quotas as goals and guidelines. Where state laws forbid forcing Americans to identify themselves by race, investigators are hired to determine the ethnic composition of faculties and students by visual inspection and snooping—practices reminiscent of Nazi Germany and wholly at variance with the traditions of free countries.

At stake are $14 billion of Federal research contracts plus the limitless ability of the Washington bureaucracy to impose legal harassment on educational institutions which refuse to knuckle under.

The paperwork involved in compliance is so vast that Columbia University had to charge the public $17.25 for copies of its 1972 Affirmative Action program. Small colleges which protested they cannot afford to fill out the forms and reports required by H.E.W. have been told to comply or go under.

One standard that has been advanced is that women and/or members of minority groups must be hired in preference to white males if the minority applicants have skills equal to those of the least competent member of the faculty. Application of this standard means an obvious and calamitous degradation of American academic standards.

Neither H.E.W. nor the evil genius of the program, J. Stanley Pottinger, who has recently been rewarded by promotion, has ever defined minorities. Italo-Americans are included in some Affirmative Action programs; excluded in others. As smaller ethnic groups become aware of the limitless possibilities of the program, their members begin to organize pressure groups to get free passes on the race-minority "gravy" train. In theory, Orientals are such a minority, but a Chinese

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friend assures me that they are as ruthlessly discriminated against as are Jews and Americans of West European extraction. All three groups are highly capable and the Pottinger program is evidently designed to favor only those groups which have been unable to make it on their own.

While Negroes are invariably included, some of the more farsighted black leaders have seen the boomerang potential of the program. Thus, Economics Professor Thomas Sowell, a man with an I.Q. of 142 (the same as that of President Kennedy and higher than that of 99 per cent of the white U.S. population) found a mimeographed invitation to teach at Swarthmore which needed "a black economist" unattractive to him "as a scholar or a man." Qualified Blacks have been turned down by leftists in the program because their I.Q.s were too high or because they were not militant enough.

Some white professors automatically give all black students A or B grades. Even the stupidest and laziest are seldom failed. The result is that the black scholar who has earned his way academically by hard work and clear thinking is automatically classified with the "phoneys" and ethnic know-nothings as a man with a degree to which he is not entitled.

Since there are not enough competent Blacks, Chicanos, Mexicans and American Indians to meet H.E.W.-imposed goals, the universities are compelled to pad their staffs with incompetents and semi-literates. Capable teachers, who have the misfortune to belong to the underprivileged race and sex, face possible dismissal and probable denial of promotion. Young white male scholars, who have devoted years to earning their doctorate so they can qualify for a life of teaching and research, are denied such employment regardless of ability.

Under the leadership of Sydney Hook, some of the most prestigious scholars in the U.S. are organizing a growing protest against this iniquitous racist system with its totalitarian overtones. The politicians, however, continue to equivocate and doublespeak. Up to now, President Ford has not displayed the elementary courage needed to cut out this cancer which threatens to reduce American higher education to the miasmal level that one might expect in a banana republic.

Dr Roche has exposed this system in a treatment which is admirably dispassionate, factual and brief. He has shown that it is not only unjust and inhuman (in that it reduces the individual to a statistical norm), but that it has two major practical disadvantages.

The first of these is that the quota system substitutes the incompetent for the competent on the hypothesis that the former belong to a category which has the same potential as that of those displaced. The second disadvantage is less frequently perceived. It is that the quota system automatically rewards the inept because members of underrepresented minorities can almost always find positions in fields or occupations that most members of their group avoid. Female paratroopers, welders and telephone line repairmen will probably always be in short supply as will Jewish hodcarriers, Armenian steeplejacks and Negro accountants. This creates golden opportunities for minority members who are sharp enough to find sinecures, but not industrious enough to hold down regular jobs.

Dr Roche has carefully avoided the issue of differences in the racial I.Q. pattern, while emphasizing individual differences in intelligence and ability. Yet this is the crux of the matter as far as the Negro-White problem is concerned. In the 1965 edition of her standard textbook (*The Psychology of Human Differences,* Appleton-Century-Crofts, New York, 3rd edition), Dr Leona E. Tyler wrote: "It is *improbable* that a person with an I.Q, below 125 will succeed at a first-rate graduate school" (p. 76). Now if the average Negro I.Q. is 85 and the standard deviation of the normal curve of error is 15 I.Q. points it is mathematically evident that about 4.8 per cent of the nation's 190 million Whites, as against 0.6 per cent of the nation's 20 million Blacks, qualify by the Tyler standard. This means 9.1 million Whites as compared with 80,000 Blacks. It is evident from these approximate figures that there are not nearly enough American Blacks with the potential required to fill the college faculty and other high-echelon positions which the egalitarian bureaucrats attempt to reserve for them.

NATHANIEL WEYL.

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THE CHOSEN PEOPLE: A CONTROVERSIAL HISTORY OF THE JEWS

By John M. Allegro. Doubleday and Company, Garden City, New York, 1972. Pp. 320, 24 plates. Price $10.

Few people have received so much attention from historians, philosophers, and theologians as the Jews. From all that has been written, the ethnic and cultural origins which account for their ethno-psychology have not been adequately elucidated. This is partly due to a tendency to accept their own descriptions, full of self-protective coloration. John Allegro appears to show the way back, past this camouflage, to a better understanding of Jewish thought and motivation.

Formerly lecturer in Old Testament and Inter-Testamental Studies at Manchester University, Professor Allegro brings to his subject scholarship and orginality. Whether or not we accept his theories of Judaic or Christian origins, there is, of course, weight in his bringing together of biblical knowledge and a command of the ancient history and linguistics of the Near East.

From these relatively fixed positions, Allegro draws a triangulation to fix the origins of Jewish hubris and anti-Jewish thought and action or "anti-semitism." For him, keeping the Sabbath and circumcision are but two aspects of a fertility cult and have their origins deep in the consciousness of man. From this the observance of these customs became, for the Jews who had been exiled to Babylon and later returned to rebuild the walls of Jerusalem, an expression of their faith and a distinguishing mark that served to link them with their tribal history. Racial purity was made obligatory by the prophet Nehemiah, persisting strongly in contemporary intra-Jewish communication. He argues that the continuation of the belief that they are the Chosen Race, through and into the Christian era, that all history is directed to their glorification, causes strife between them and their neighbours.

> . . . the doctrine of the Chosen Race whose working out in practical politics was to wreck such havoc among the nations of the world and to bring successive disasters upon the Jews themselves. The history of the Jews as revealed in the Torah became in a sense co-extensive with the story of mankind, and in Adam's supremacy over the beasts of the field could be seen the eventual dominion of the Jews over the world. Thus, unwittingly, the Babylonian Jews laid the foundation of an anti-Semitism which was henceforth to blot the pages of human history.

However, many authorities would not agree with him on the fertility cult conception behind either circumcision or the Sabbath.

Much Jewish activity has been directed toward changing Christian beliefs and attitudes which were thought to be the cause of anti-Jewish hostility. Such hostility has existed before and apart from Christianity. Professor Allegro demonstrates anti-Jewishness as a survival response by non-Jews to the Jewish mystique itself.

ROBERT JOHN.

SIR OLIVER LODGE: PSYCHICAL RESEARCHER AND SCIENTIST

By W. P. Jolly. Constable, London, 1974. Pp 255, 9 illustrations. Price £3.95.

Sir Oliver Lodge, F.R.S., President of the Royal Society, and the British Association, with over a dozen honorary degrees, is a good example of heredity over environment. His father was the 23rd of 25 children who left school at 14 and, although apprenticed to an elder brother who was a doctor, left that calling to become a potter. Oliver Lodge at 14 also left school to follow his father's career. Both his grandfathers had been headmasters, and among his many uncles were teachers, ministers of religion and businessmen.

Lodge looked back with horror at the cruelties he and other boys perpetrated on

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birds' nests and their eggs. He came to the conclusion that a vein of cruelty is natural in children, and that they are retracing the steps of ancestry.

At 14 he was removed from school, and became the *and son* in *Lodge and Son*. For seven years he worked in the potteries. His maternal aunt, the daughter of a headmaster, who was Woman of the Bedchamber to Queen Adelaide, had interested him in astronomy and steam engines while a child. He was allowed to stay with her, and there he attended classes on geology at King's College, on chemistry at the College of Chemistry, London, and constitutional history at University College, London. After a winter of this he returned home to work with his father in the Potteries, where he studied, apart from his work, in the Athenaeum at Stoke-on-Trent, the Wedgewood Institute at Burslem, and the Potteries Mechanics Institute at Hanley. The courses were intended for working men and the fees were cheap and within Lodge's range.

Lodge learned of the London University external degree, and soon put himself down for it—Matriculation, part I, and part II. The Matriculation involved Latin, Greek, and other foreign languages, geography, history, mathematics, natural philosophy, and chemistry. In fact, I am certain, that degrees have become progressively easier since those days, as the numbers passing through our universities have increased.

The point is that without schooling Lodge achieved what he did, and once more demonstrates that it is rather in the heredity than the environment that the truth lies.

So much space has been taken over the first few pages of this fascinating book that we have not had space to deal with his real (later) life, and his work for physics and psychic research. Sufficient has, however, been given to whet the appetite for obtaining the book and reading more about him.

R. GAYRE OF GAYRE

TENEMENTS OF CLAY: MEDICAL BIOGRAPHIES OF FAMOUS PEOPLE

Edited by Arnold Sorsby. Julian Friedmann, London 1974. Pp. 258, 37 illustrations. Price £3.50.

The editor writes on Noah and makes him an albino. This seems far-fetched. The description is rather of a Nordic or East Baltic child. "Job's illness—Pellagra," by Charles J. Brim, might well have been the case. "The Medical Problems of Henry VIII," by Ove Brinch, might well have been syphilis, and he makes out a good case. "Shakespeare's Skull and Brain: An Anthropological Study," by Arthur Keith, is prefaced by an editorial note. Sir Arthur had said he was of Beaker lineage, and the editor goes on to say this is doubtful, and that anthropologists no longer attach much importance to the shape—which is nonsense, if he means other than social anthropologists who know nothing about the matter. It is a fact, Shakespeare, the Cecils, Charles Darwin, and Sir Oliver Lodge, and other outstanding people have the short high head of the Beaker folk. There is a clear alignment of the Dinaric or Dinaric × Nordic type with intelligence.

Keith draws attention to the difference between the skull of Burns (a long head, probably Mediterranean × Nordic) and Shakespeare (Beaker folk). Keith observes that Shakespeare is a descendant of the Bronze Age invaders—a stock which spread from Germany, France, and into Italy, and which has produced "the world's finest artists." That I would be inclined to modify by saying it has produced *some* of the world's finest artists. This shape of skull is not due to acrocephaly although, in the case of Sir Walter Scott, there may have been a slight condition of this kind.

Ralph W. Leftwich writes on "Evidence of Disease in Shakespeare's Handwriting." He finds that Shakespeare suffered from writer's cramp, or

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scrivener's palsy, which is hardly surprising! He suggests that this is why he gave up play-writing at 46 years of age.

Arnold Sorsby writes on Milton's blindness. It seems that there was eye-trouble in both his father's and mother's line, and this may have accounted for myopia in his. T. G. Wilson deals with "Swift's Deafness and His Last Illness." He holds he suffered from Ménière's desease.

"Samuel Johnson's Medical Experiences" is contributed by Humphry Rolleston. Among other things, he suffered from high blood pressure, a gallstone, tubercular glands, impaired vision, deafness, and "tics."

"The Insanity of King George III: A Classic Case of Porphyria," is by Ida Macalpine and Richard Hunter, and John Brooke follows with a chapter on "Historical Implications of Porphyria." This deals with George III and IV, but it goes back to Queen Mary of Scots.

"Jane Austen's Last Illness" is written by Zachary Cope, who diagnoses Addison's disease. "Beethoven's Deafness," is dealt with by Maurice Sorsby. It appears to have been due to cirrhosis. The "Illness and Death of Napoleon," by Arnold Chaplin, would seem to indicate it was due to a stomach ulcer around the edges of which cancer developed. "Darwin's Health in Relation to His Voyage to South America" is by A. W. Woodruff. He holds that Darwin did not die of Chagas' disease but of an anxiety state with obsessive features and psychomatic manifestations. Finally "Abraham Lincoln's Marfan Syndrome," is dealt with by Harold Schwartz. He appears to confirm the diagnosis.

R. GAYRE OF GAYRE

THE MEASUREMENT OF INTELLIGENCE

By H. J. Eysenck. Medical and Technical Publishing Company, 1973. Pp. 488.

This book is a collection of thirty papers on intelligence. They cover the organisation of intelligence, hereditary and environmental influences, the relationship of intelligence to social class and some of the recent work on the biological basis of intelligence in the nervous system.

Several of the papers demonstrate in different ways the large contribution of heredity to the variance in intelligence. In the section on intelligence and social class there are several papers showing that intelligence contributes substantially to upward social mobility and to income. There is also a paper discussing the latest evidence on the thesis that intelligence levels in advanced Western nations may be declining as a result of the tendency of low I.Q. groups to have greater numbers of children.

Perhaps the most important discovery in the field of intelligence in the last decade is the tendency of intelligent people to have faster evoked potentials on the E.E.G. The original discovery by Ertl has now been confirmed several times, and one of the confirmatory studies is published in this volume. It looks as if at long last a psychological basis of intelligence has been isolated.

The volume concludes with an essay by Professor Eysenck defending the concept of general intelligence and the methodology of intelligence testing. He draws analogies between the development of intelligence tests and measuring instruments in the physical sciences such as the thermometer and shows their essential similarity.

This volume provides a most useful collection of papers and Professor Eysenck has performed a valuable service in assembling them together.

RICHARD LYNN

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Journals Received

TERZO MONDO

Published by the Central Studi Terzo Mondo, Milan. Price Ll.200. Vol. VII, No. 26, 1974.

NEUE ANTHROPOLOGIE

Quarterly journal published by Gesellschaft für Biologische Anthropologie Eugenik un Verhaltensforschung, 2 Hamburg 55. Vol. 3 No. 1, 1975.

POPULATION

Revue Bimestrielle de L'institut National d'Etudes Demographiques, Paris. Price F12.00. Vol. 29, No. 6, 1974, Vol. 30, No. 1, 1975.

ETHNOLOGY

A quarterly journal, University of Pittsburgh, 4200 5th Avenue, Pittsburgh 15213, U.S.A. Price $7 a year. Vol. XIII, No. 4, 1974, Vol. XIV, No. 1, 1975.

GENUS

Journal of the Italian Committee for the Study of Population Problems, and the Italian Society of Eugenics, via delle Terme di Diocleziano. Price L3.000. Vol. XXIX, Nos. 3-4, 1973.

ANTHROPOLOGIE

Published by Moravske Muzeum, Ustav Anthropos, Brno, Czechoslovakia. Vol. X, Nos. 2, 3, 1972, Vol. XI, Nos. 1, 2, 1973.

ANTROPOLOGICA

Journal of the Instituto Caribe de Antropologica y Sociologia, Fundacion La Salle de Ciencias Naturels, Apartado 8150, Caracas 101, Venezuela. Price $1.75. No. 36, 1973.

REVISTA DE ESTUDIOS POLITICOS

A quarterly journal, Instituto de Estudios Politicos, Plaza de la Marina, Madrid. Price 175 ptas. Nos. 197, 198, 1974.

TERRA AMERIGA

Published by the Associazione Italiana Studi Americanistici, Genoa, Italy. Vol. X, Nos. 31-32, 1974.

ALASKA

Monthly journal published by Alaska Northwest Publishing Company, Anchorage, Alaska. Price $1.00. January, February 1975.

JOURNAL OF INDO-EUROPEAN STUDIES

A quarterly journal, Box 5224, S. Station, Hattiesburg, Mississippi 39401. Price $9.00 a year. Vol. 2, No. 2, 1974.

INTERNATIONAL MIGRATION REVIEW

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Professor Giovanni Tucci

In 1974 we lost another eminent Italian scholar of the Science of Man, Professor Giovanni Tucci of the University of Naples. Born in 1906, he died in Naples in February 1974. An ethnologist of the Neapolitan School of Professor Corso, he began to publish in 1929 (with the paper *Nomi*) a collection of psychological studies. He was the first to divulge in Italy the study of Wellerism.

In 1945 he founded *Rivista di Etnografia* which was the only journal in Italy in this field of studies, and he was its director up to the time of his death.

Of his great number of publications, I would cite particularly: *Sistema monetario Africano alla luce dell'economia primitiva, Il segreto della cultura, Antropologia culturale* and *Dicette Pulicenella.*

Professor Tucci was a very studious and genial writer, who united his brilliant psychical qualities derived from his Lucanian origin to half a century of constant study of ethnology.

His journal continues under the title *Etnologia-Antropologia Culturale.*

MARIO CAPPIERI

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